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BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

VOL. XXXII APRIL, 1961 NO. 2

WING LENGTH AS AN INDICATOR OF WEIGHT: A CONTRIBUTION

BY A. L. RAND

Wing length, measured from wrist to tip of longest primary, is often used as an indicator of weight when comparing bird populations and their adaptation to climate. Reasonable as this seems, actual data demonstrating the extent to which wing length is a reliable weight indicator, is scanty. It seems worthwhile to present some original data from Philippine song birds, and interpret it along with certain items from the literature, and to point out that bird banders can make additional use of the weights and measurements they take by interpreting them along these lines.

BACKGROUND

Despite the great individual and temporal variation in bird weights, they do seem to represent specific and even population characters. The wing length of course, when fresh, full grown wings of the same age and sex class are measured, is much less variable.

The intricacies of the question of bird weights has been discussed a number of times, especially by Nice, 1938 (biological significance); Poole, 1938 (wing loading); Amadon, 1943 (in taxonomy); Mayr, 1956 (and climatic adaptations); Saville, 1957 (adaptations wing-weight for flying); and Odum, 1958 (variation in migrants of different types).

The present paper is a contribution to only the narrow problem of the reliability of wing length as an indicator of weight in some song birds.

CORRELATIONS WITHIN SPECIES

In twenty-one Philippine species.—The collections made in recent years by Dr. D. S. Rabor of Silliman University, Dumaguete, Negros, P. I., from the three islands of Bohol, Samar, and Mindanao had the weights recorded on the labels of the specimens. For purposes of the following table only those song birds species of which at least three adult males were available from each of at least two of the islands were used. This curtailed sharply the number of species that could be used, to the twenty-one listed (Table 1).

For deciding whether or not differences existed, a difference of 3 millimeters in wing length, or 1 gram in weight between the populations of different islands was arbitrarily taken as the lowest acceptable difference. Using this, the following conclusions were arrived at. Of these 21 species, ten species showed no differences in wing or weight between populations of different islands. In ten species the populations

TABLE I.

Wing lengths and weights of different island populations of 21 species of Philippine Island songbirds, males only.

Species	Bohol				Mindanao				Samar			
	Wing		Weight		Wing		Weight		Wing		Weight	
	No.	Av.	No.	Av.	No.	Av.	No.	Av.	No.	Av.	No.	Av.
Coracina striata	(5)	162 mm.	(5)	109 grams	—	—	—	—	(3)	166	(3)	116
Hypsipetes philippinus	(9)	100.3	(9)	41.5	(4)	120	(3)	59	(15)	95.2	(15)	38.3
Pycnonotus goiavier	(6)	83	(5)	27.5	—	—	—	—	(14)	80.2	(14)	27.8
Irena cynogaster	(11)	134.1	(11)	79.6	—	—	—	—	(7)	132.6	(7)	86.2
Ptilocichla mindanensis	(9)	71.9	(9)	29.7	—	—	—	—	(3)	70.1	(3)	29.4
Macronus striaticeps	(10)	62.9	(8)	15.3	(5)	63.7	(4)	19	(10)	61.8	(10)	16.2
Stachyris nigrocapitata	(3)	70.8	(2)	14.8	—	—	—	—	(14)	69.3	(4)	14
Phylloscopus olivaceus	(11)	60.7	(10)	10	(4)	62	(4)	11.5	(12)	62.3	(12)	10.5
Cisticola exilis	(10)	44.9	(8)	7.1	—	—	—	—	(3)	44.2	(3)	6.8
Rhipidura superciliaris	(10)	78.9	(10)	13.7	(3)	83	(3)	15.6	(12)	79.6	(12)	13.5
Hypothymis azurea	(3)	69.6	(3)	11.5	—	—	—	—	(6)	65.6	(6)	11.1
Pachycephala philippinensis	(14)	82.7	(14)	21.5	(14)	84.2	(12)	23	(10)	82.6	(10)	22.3
Dicaeum trigonostigma	(4)	49.5	(3)	7.3	—	—	—	—	(12)	49.9	(12)	7.2
Dicaeum hypoleucum	(5)	53.6	(5)	8	(4)	53.8	(4)	8	(10)	51.5	(10)	7.9
Dicaeum australe	(6)	55.6	(4)	8.7	—	—	—	—	(10)	55	(10)	8.7
Arachnothera clarae	—	—	—	—	(5)	90	(5)	31	(6)	89.3	(6)	30.9
Aethopyga pulcherrima	(5)	49	(5)	5.4	—	—	—	—	(20)	49.3	(20)	6.6
Nectarinia jugularis	(19)	56.3	(18)	9.2	—	—	—	—	(4)	57.7	(4)	9.1
Nectarinia sperata	(3)	50.3	(3)	5.5	—	—	—	—	(23)	50.9	(23)	6.7
Zosterops everetti	(10)	54.8	(10)	10.2	(4)	57.5	(3)	10.8	(10)	55	(10)	9.7
Sarcops calvus	(6)	132.1	(6)	144.6	—	—	—	—	(10)	132.9	(10)	145

in which the individuals averaged longer wing also averaged heavier. In one species only did the populations with longer wing length weigh less *(Irena)*. The observed differences in wing length were considerably less than the differences ordinarily used to give subspecific rank to a population, except in one species *(Hypsipetes)*.

From this data it appears that within these species wing length correlates closely with weight within 20 out of 21 species.

TABLE II.

Wing length and weight of nine populations of Pigmy Nuthatch, *Sitta pygmaea melanotis*, males only (data from Norris, 1958).

Locality	Wing		Weight	
	No.	Av.	No.	Av.
Idaho, etc.	(15)	62 mm.	(1)	9.6 grams
Napa Co., California	(77)	62	(8)	9.9
Brit. Columbia-Oregon	(33)	63	(10)	10.0
No. Sierra, California	(23)	63	(16)	10.3
W. Nevada	(13)	63	(9)	10.7
New Mexico	(35)	64	(5)	10.2
E. Nevada	(48)	64	(7)	10.3
N. Coahuila	(9)	64	(9)	10.4
So. Sierra, California	(41)	65	(20)	10.6

Pigmy Nuthatch, *Sitta pygmaea.*—The data in Table 2 shows the correlation between wing-length and weight in nine populations within the subspecies *S. p. melanotis.* Considering that the total difference in wing length is only four millimeters and that in weight is only just over one gram, the close though not absolute correlation within the series is more than one would expect. Yet the size of the samples used makes one think that the correlation is probably real.

The data for the rest of the subspecies, Table 3, does not show as close a correlation, though the longest winged subspecies is also the heaviest. However, the shortest winged birds are not the lightest, and the next to the longest winged are next to the lightest.

Scrub jays, genus *Aphelocoma.*—*A. coerulescens,* from the data in Table 4, also shows a general correlation of increased weight with increased wing length. There are particularly striking exceptions: the subspecies *nevadae* and the subspecies *sumichristi* and part of *superciliosa* are much lighter than the wing length would lead one to expect. It should be noted that two of these exceptions are subspecies in different subspecies groups that could be considered as representing two separate species, judging by standards other than those Pitelka (1951, p. 376) accepts. He also comments on the habitat relation of the populations with relatively different wing length and weight.

In another scrub jay, *A. ultramarina,* Table 5, which is longer winged than *A. coerulescens,* only some of the populations are heavier, and the correlation of wing-weight within the series has many exceptions. These

TABLE III.

Wing length and weight of seven subspecies of pygmy nuthatch, *Sitta pygmaea,* except *melanotis;* males only (data from Norris, 1958).

Subspecies	Locality	Wing		Weight	
		No.	Av.	No.	Av.
pygmaea (pt.)	Marin Co., California	(33)	59 mm.	(18)	10.4 grams
pygmaea (pt.)	Monterey Co. (1), California	(42)	62	(10)	10.9
chihuahuae (pt.)	Durango, etc.	(20)	63	(3)	9.3
pygmaea (pt.)	Monterey Co. (2), California	(14)	64	(14)	10.9
chihuahuae (pt.)	W. Chihuahua	(24)	65	(8)	10.4
flavinucha	W. Puebla	(20)	65	(2)	10.4
brunnescens	Jalisco, etc.	(11)	66	(1)	10
leuconucha	Lower California	(55)	68	(33)	11.4

TABLE IV.

Wing length and weight of nineteen subspecies and populations of the scrub jay, *Aphelocoma coerulescens*, males only (data from Pitelka, 1951).

Subspecies	Locality	Wing		Weight	
		No.	Av.	No.	Av.
coerulescens	Fla.	(16)	115 mm.	(2)	78 grams
cactophila	Central Lower Calif.	(25)	118	(10)	79
obscura	No. Lower Calif.	(56)	121	(51)	78
obscura	San Diego Co., Calif.	(30)	121	(6)	79
hypoleuca	Cape area, Lower Calif.	(36)	121	(10)	85
californica (pt.)	Central coastal Calif.	(22)	123	(14)	95
caurina	No. coastal Calif. and Oreg.	(38)	123	(29)	98
californica (pt.)	Inner coast range, etc., central Calif.	(16)	125	(15)	93
superciliosa (pt.)	Calaveras, Calif.	(39)	124	(39)	93
superciliosa (pt.)	Sacramento Valley, etc., Calif.	(42)	124	(16)	97
superciliosa (pt.)	San Joaquin Valley, Calif.	(34)	126	(27)	97
oocleptica	Marin Co., Calif.	(16)	127	(7)	100
oocleptica	Contra Costa, Calif.	(21)	126	(7)	106
superciliosa (pt.)	No. Calif., Oreg.	(38)	128	(27)	93
nevadae	Calif.—Nevada line	(33)	130	(33)	81
nevadae	Arizona	(39)	131	(6)	77
nevadae	Nevada	(17)	131	(17)	81
insularis	Santa Cruz Isl.	(45)	139	(20)	125
sumichrasti	S. E. Mexico	(8)	143	(5)	100

exceptions do not all accord with the subspecies groups outlined by Pitelka (1951, p. 376).

CORRELATIONS BETWEEN SPECIES

The data presented above shows that the correlations between change in wing length and weight may be rather precise in many cases within species. However, this is not always true.

Such discrepancies could be the sort of material which selection could use in establishing species. Hence, we could expect to find deviation from the increase in wing and weight postulate better established at the species level and the factors with which they are correlated to be more easily seen when distantly related birds are compared With this in mind the following are pertinent.

TABLE V.

Wing lengths and weights in nine subspecies and populations of the scrub jay *Aphelocoma ultramarina*, males only (data from Pitelka, 1951).

Subspecies	Locality	Wing		Weight	
		No.	Av.	No.	Av.
couchii	Texas	(35)	153.8 mm.	(3)	102 grams
couchii	So. Coahuila, etc.	(18)	156.9	(4)	125.7
couchii	So. Nuevo Leon, etc.	(21)	158.8	(2)	104.3
wollweberi	Durango, etc.	(28)	160.9	(4)	86
arizonae (pt.)	No. Sonora	(16)	163	(9)	120
sordida	E. central Mexico	(7)	164.3	(2)	133
arizonae (pt.)	S. E. Arizona	(14)	170	(8)	135
ultramarina (pt.)	Michoacan	(16)	175.9	(8)	140.6
ultramarina (pt.)	Vera Cruz, etc.	(17)	180.6	(4)	130.5

TABLE VI.

Wing lengths and weights of eight species of flowerpeckers, of the genus *Dicaeum* of the Philippines, males only.

Species	No.	Wing Av.	Weight Av.
pygmaeum	(3)	45 mm.	5 grams
trigonostigma	(12)	50	7
bicolor	(4)	51	8
hypoleucum	(10)	51	8
ignipectus	(3)	55	9
australe	(10)	55	9
anthonyi	(2)	57	12
nigrilore	(10)	58	11

SPECIES WITHIN A GENUS

By definition, the members of a genus are closely related, and the same general type of bird. The eight species of the genus *Dicaeum* of the Philippines, Table 6, show a remarkably close wing length-weight correlation. The seven species of woodwarblers of the genus *Dendroica*, Table 7, show a general correlation and the two exceptions are not greater than found in subspecies of the pygmy nuthatch. There are also exceptions in populations of the two species of scrub jay, Table 4 and 5, as mentioned earlier.

TABLE VII.

Wing length and weight of seven species of *Dendroica*, males only (data from Woodford and Lovesy, 1958).

Species	No.	Wing Av.	Weight Av.
magnolia	(51)	59 mm.	9.6 grams
virens	(4)	61	10.4
pennsylvanica	(8)	62	10.0
palmarum	(2)	62	11.2
petechia	(6)	63	10.7
fusca	(4)	66	11.2
coronata	(9)	72	12

SPECIES IN DIFFERENT GENERA IN A FAMILY

Here we deal with species with less close relationships, and which may be rather different types of birds.

The three species of Philippine babblers, family Timaliidae of which we have data, Table 8, do not show correlation of wing and weight. Here for the first time another correlation is plainly evident. The first species, *P. mindanensis* with the heavy weight, is a bird of the forest floor that presumably flies little. The second species, *M. striaticeps* with a lighter weight for its wing length, is a bird that hops in the shrubbery in the forest. The third, *S. nigrocapitata* with lightest weight for its wing length, is a bird that feeds among the twigs and branches of the trees, not unlike a wood warbler, and its wing-weight relation approaches that of *Dendroica coronata* of Table 7.

TABLE VIII.

Wing length and weight of three Philippine babblers, Family Timaliidae, males only.

Species	No.	Wing Av.	Weight Av.
Ptilocichla mindanensis	(3)	70 mm.	29 grams
Macronus striaticeps	(10)	62	16
Stachyris nigrocapitata	(2)	70	14

TABLE IX.

Wing length and weight of various woodwarblers, Family Parulidae, males only (data from Woodford and Lovesy, 1958).

Species	*No.*	*Wing Av.*	*Weight Av.*
Geothlypis trichas	(16)	55 mm.	11 grams
Setophaga ruticilla	(6)	63	8.2
Wilsonia canadensis	(20)	64	10.4
Wilsonia pusilla	(21)	54	8.1
Vermivora peregrina	(3)	64	11.3
Vermivora ruficapilla	(4)	56	11.4
Mniotilta varia	(2)	68	11.4
Icteria virens	(5)	72	23.1
Dendroica coronata (large species)	(9)	72	12
Dendroica magnolia (small species)	(51)	59	9.6

In the wood warblers data from seven genera in Table 9, various discrepancies emerge in regard to the wing-weight correlations. The chat *(Icteria)* and the yellowthroat *(Geothlypis)* both have much heavier weight, and the redstart *(Setophaga)* has a lighter weight than a comparison, on wing length alone, with the species of *Dendroica* would lead one to expect. However, in these cases it is plainly correlated with habits: the chat and yellowthroat are more skulking birds of the shrubbery than the *Dendroica* species, and the redstart is more aerial. However, there is another discrepancy, the heavy weight of the Nashville warbler, *V. ruficapilla*, compared with that of the Tennessee warbler, *V. perigrinus*, despite both having similar habits.

NORTH AMERICAN SONG BIRDS OF VARIOUS FAMILIES

A selection of North American song birds given in Table 10 illustrates how birds with longer wings tend to have heavier weights, comparing birds of quite different sizes, but that the correlation of wing-weight is greatly influenced by habits. Birds of the ground and

TABLE X.

Wing lengths and weights of selected North American songbirds from various sources.

Species	*Wing Av.*	*Weight Av.*
House Wren, *Troglodytes aedon*	51 mm.	11 grams
Golden-crowned Kinglet, *Regulus satrapa*	56	5.7
Swamp Sparrow, *Melospiza georgiana*	62	17
Chestnut-sided Warbler, *Dendroica pensylvanica*	62	11.1
Solitary Vireo, *Vireo solitarius*	75	16.5
White-crowned Sparrow, *Zonotrichia leucophrys*	75	26.5
Catbird, *Dumetella carolinensis*	88	39
Cedar Waxwing, *Bombycilla cedrorum*	95	25
Rose-breasted Grosbeak, *Pheucticus ludovicianus*	101	40
Scrub Jay (Florida), *Aphelocoma c. coerulescens*	115	78
Barn Swallow, *Hirundo rustica*	118	17
Eastern Meadowlark, *Sturnella magna*	122.4	145
Blue Jay, *Cyanocitta cristata*	134	89
Purple Martin, *Progne subis*	142	43
Common Grackle, *Quiscalus quiscula*	144	122
Common Crow, *Corvus brachyrhynchos*	321	552.5

TABLE XI.

Wing lengths and weights of seven selected non-passerine birds; data from various sources.

Species	*Wing*	*Weight*
Virginia Rail		
Rallus limicola	106 mm.	119.0 grams
Chimney Swift		
Chaetura pelagica	111	17.3
Bobwhite		
Colinus virginianus	111	191.0
Pied-billed Grebe		
Podilymbus podiceps	130	343.0
Yellow-billed Cuckoo		
Coccyzus americanus	143	61.0
Leach's Petrel		
Oceanodroma leucorhoa	157	26.5
Common Nighthawk		
Chordeiles minor	197	75.0

shrubbery, such as wren, sparrows, catbird, Florida jay, meadowlark, have much heavier weights than do birds of somewhat similar wing length that live in the trees, as kinglets, warblers, vireo and waxwing, or catch their food on the wing, as do swallows and martins.

A FEW SELECTED NON-PASSERINE BIRDS

Though the data presented so far has been restricted to passerine birds, it seems advisable to present a selected few examples of non-passerines from within the common wing length range of song birds to illustrate how great can be the range of weight within birds of somewhat similar wing length, but of very different habits and distant relationships, Table 11.

Evidently the very different manner of life has influenced the wing-weight relationship. Birds that depend on their wings a great deal, like swifts, nighthawks and Leach's petrels, have long wings and light weight; those that depend on their legs for locomotion, like rails, grebes, and quail, have heavier bodies and shorter wings.

SUGGESTIONS

One of the difficulties in interpreting wing-weight relationships is that weights and measurements of the same birds are not available for good sized samples. Here bird banders and those collecting birds from major disasters such as those at radio towers can make a contribution.

"General size" of a bird is a meaningless term, except by definition; total length, wing length, weight, or whatever unit is used should replace it.

The use of formulae and derived ratios are tempting complications, such as using the cube root of weight to compare with the lineal wing length (since mass increases as the cube of a lineal measurement). However, wing loading would seem a better next step in correlating wing-weight relations. Though there is a general relation between wing loading and weight, as heaviest wing loading occurs only in longer-winged flying birds, lightest only in shorter-winged flying birds (Poole,

1938), this general tendency seems often upset by the birds' adaptation to a way of life. For instance, the wing loading of the grebe (wing, 130 mm.) is about ten times that of the Leach's petrel (wing, 157) of Table 11. Many facets of the bird as a flying machine are discussed by Saville (1957).

As a bird bander at one station can work best with one or at most a few populations of a species, cooperative use of data from a series of stations where populations of a species are known to differ in size, as in different subspecies, might be productive. The analysis of the data could be directed toward attempting to see if differences in the wing-weight relationships were correlated with local habits, with migration, and fat deposition, or with some aspect of the habitat.

DISCUSSION AND SUMMARY

In closely related bird populations, comparison of size as determined by wing length may be a fairly delicate indicator of comparative weights. However, even at the subspecies level or below it, wing length may fail as a weight indicator.

With species in a genus, species in different genera in a family, and species in different families and orders, the "increase in weight with increase in wing length" correlation becomes increasingly disrupted.

The most obvious factor correlating with these conspicuous disruptions in quite different birds is the manner of life, as is seen by comparing an aerial feeding swallow and an arboreal jay (Table 10), or a Leach's petrel that feeds in fluttering flight, with a grebe that feeds on or in the water or a quail that feeds on the ground (Table 11).

Probably some of the minor discrepancies seen in comparing the wing-weight relations of closely related populations may be due to minor adaptations to slightly different ways of life. If these were adaptations to different types of habitat, themselves due to different types of climate in different areas, the differences might mistakenly be ascribed directly to climatic factors and correlated physiology. A tentative generalization is that birds which fly more have larger wings, relative to their weight.

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FURTHER STUDIES ON NESTING OF THE COMMON NIGHTHAWK

By RALPH W. DEXTER

The Common Nighthawk *(Chordeiles minor minor)* has nested on the campus of Kent State University at Kent, Ohio, since 1948, and reports have been published through the season of 1956 (Dexter, 1952; 1956). In 1957, Nighthawks returned to the campus on May 12. They had also been found five days earlier on the roof of the Akron City Hospital, where they had been studied in 1953, but the writer was unable to continue his studies in the season of 1957.

In 1958 the Nighthawks again returned to the Kent campus on May 12. A pair was located on the roof of Wills Gymnasium incubating two eggs on June 1. For the first time in seven years of nesting on the campus, the eggs were placed on the open roof at some distance from the protection of a wall. Previously, the eggs had always been deposited in a corner where the walls of the roof formed a right-angle bend. This new situation presented an opportunity to study the orientation of the incubating and brooding female in relationship to the direction of sun-rays and prevailing wind. Weller (1958) published a detailed study on the orientation of this species to sunlight. His observations are compared with the present study, and additional relations are noted here.

On June 5, 1958, the incubation behavior was observed continuously from sundown until total darkness. Just at sundown, the male came to the roof of Wills Gymnasium, flew over the roof-top several times in power dives, and then landed about one foot away from the female incubating the eggs. After several minutes, he left. At twilight he returned and again circled the roof, giving his characteristic call, and landed on the roof some distance south of the female. He called to the female several times, then flew to a position near her. After several minutes, he again left the roof. At dusk, when he was barely visible, he returned to the roof, but this time flew in silently and replaced the female at the nest. He continued incubating the eggs until it was too dark to see further. This is the first time the writer has observed the male taking part in the incubation of the eggs.

On June 6, at 10:30 P.M., the writer flushed the adult bird on the nest and listened to peeping sounds coming from one of the two eggs. The next day this egg was hatched. That evening the male joined the female on the roof at 9:15 P.M. On June 8, the female was captured in a drop trap and proved to be No. 42-232611, which has nested on our campus since 1950. The nestling was banded with No. 512-45998. The male circled overhead, while the female was being captured and the nestling was banded, but he did not land on the roof at any time the writer was in sight.

Table I. Orientation of Nesting Nighthawks to Sunlight and Prevailing Wind

A. Female 42-232611 with nest on open roof.

Date 1958	Time E.S.T.	Direction of Sun	Direction of Wind	Facing Direction of Nighthawk	Notes
6-1	4 P.M.	W	NW	NW	Intermittent sunlight between clouds. Bird facing strong wind after storm
	7 P.M.	—	N	NW	Dusk: light rain
6-2	7:30 A.M.	—	NE	E	Cloudy
	Noon	—	E	E	Cloudy; Facing wind
	3 P.M.	—	NE	N	Cloudy
6-3	7 A.M.	E	E	E	Facing both sun and wind
	10:30 A.M.	SE	SE	SE	Facing both sun and wind
	Noon	S	S	S	Facing both sun and wind
	4 P.M.	W	SE	SE	Facing wind
6-4	7:30 A.M.	E	W	E	Slight breeze only; facing sun, away from wind
	10:30 A.M.	SE	W	SE	Slight breeze only; facing sun
	4 P.M.	W	W	E	Facing away from both sun and wind. Slight breeze only
6-5	7 A.M.	E	W	E	Facing sun, away from wind
	9:30 A.M.	SE	W	SE	Facing sun
	1 P.M.	SW	NW	SW	Facing sun
6-6	8 A.M.	E	NE	E	Facing sun
	Noon	S	NE	S	Facing sun
	4 P.M.	W	NE	W	Facing sun
6-7	8:30 A.M.	E	—	E	Facing Sun, One egg hatched

B. Female 512-46000 with nest close to a northeast-southwest wall.

1959					
7-2	3:30 P.M.	—	—	S	Bird in shade of wall
7-3	1 P.M.	SW	—	NE	Facing away from sun
7-4	8 A.M.	E	—	E	Facing sun
	11 A.M.	SE	S	W	Bird at an angle to both sun and wind
	2 P.M.	SW	W	E	Facing away from wind
7-5	8 A.M.	E	W	E	Facing sun, away from wind
	Noon	S	W	W	Facing wind; at right angle to sun
7-6	1:30 P.M.	SW	NW	NE	Facing away from sun
7-7	11 A.M.	SE	NW	N	Facing toward wall
	9:30 P.M.	—	—	S	Facing away from wall
7-8	Noon	S	—	N	Facing away from sun
	4:30 P.M.	W	W	E	In shade of wall, facing away from wind
7-9	10:30 A.M.	SE	S	W	Bird at an angle to sun and wind
7-12	11 A.M.	SE	N	SE	Facing sun
7-13	10:30 A.M.	SE	N	NW	Facing away from sun
7-14	10:30 A.M.	SE	E	NW	Facing away from sun
7-15	10:30 A.M.	SE	SE	NW	Facing away from sun and wind
7-16	11 A.M.	SE	E	NW	Facing away from sun
	9 P.M.	—	—	S	Facing away from wall
7-17	11 A.M.	SE	SE	NW	1 egg hatched. Parent facing away from both sun and wind

Female Nighthawk 42-232611 was banded on the campus June 7, 1950, was recaptured on June 26, 1951, June 12, 1953, June 15, 1955 and, as reported in this paper, was recaptured again June 8, 1958, and June 26, 1959. Section A of Table I summarizes observations on this bird in relation to the direction of sunlight and prevailing wind.

Analysis of the table shows that this bird was found facing directly into the sun 80% of the time it was observed. This is contrary to the results of Weller (1958). However, he also observed that the female Nighthawk at times faced the sun, especially in the early morning. Sutton and Spencer (1949) likewise reported nestlings facing into the sun early in the morning. Only once did the writer find the female facing directly away from the sun. The observations of both Weller and the writer agree that the direction of sunlight seems to be of greatest importance in determining orientation, but the direction of orientation does not seem to be constant. Weller has reviewed the conflicting evidence in regard to this matter.

In the absence of direct sunlight, the bird often orients by facing the breeze, and at times of strong wind, faces the wind regardless of the direction of sunlight. During 33% of the time observed, this bird faced in the direction of the breeze, and during 28% of the time was facing in the general direction of the wind. Only three times was she found facing directly away from the wind, which was never strong at those times. In my earlier report (Dexter, 1956), I noted that a nesting female was observed to face directly into the direction of rain during a heavy rain storm.

In 1959, Nighthawks were first found nesting on the campus on May 6. On June 26, a female was discovered incubating two eggs in the southeast corner of the roof of Lowry Hall. The nest was located in the same place where Nighthawks had nested in 1954. The female was captured and again proved to be No. 42-232611, which has nested on the campus since 1950. The two eggs were accidentally destroyed during the trapping process, and the embryos were found to be only about one-fourth developed. They were uncommonly late since eggs from this same female have usually been hatched by that date. The destruction of the eggs was of no consequence, since workmen were in the process of removing the roof surface in preparation for a new one, and the eggs would not have hatched before being destroyed by the workers.

Interesting observations were made on the behavior of the parent birds. While these birds were heard frequently each day and night while on flights, they were very silent as they approached the eggs upon return to the nest. They never returned directly to the nest, but first landed some distance away on the roof, a wall of the roof, or some perch such as a television antenna, to permit careful scanning of the roof-top before returning to the eggs. A characteristic bowing of the head was usually observed to precede any movement to a position nearer to the nest.

On July 1, 1959, a male and female Nighthawk were found circling the roof of Merrill Hall. A search of the roof disclosed two eggs at the northeastern end of the building, about one foot out from the wall of the roof, and about twenty feet from the end of the building. Since the

eggs were not placed in a corner, this presented another opportunity to study orientation, although the situation was not ideal because of the northeast-southwest wall blocking winds from the opposite side. Some interesting data were collected and are presented in part B of table I.

At first it was thought that possibly this was the same pair which had nested on the roof of Lowry Hall as described above, and had moved over to the adjoining building for a second brood. However, this proved not to be the case when the female was later captured and found to be unbanded. This female was observed daily while incubating the eggs and for a short time while brooding the one nestling which hatched. Whenever she was disturbed, the male very soon appeared, presumably from a perch in some nearby tree, and took up guard by perching on a TV antenna attached to the roof. From this outlook he was able to observe my activities and repeatedly attempted to drive me away by diving at me with his characteristic "booming." Also, by landing on the roof at some distance away and hissing to attract attention, he gradually led me across the roof away from the nest as described in earlier accounts.

On July 17, one egg was found hatched, and the female continued to incubate the second egg as well as brood the nestling. When the female was flushed that day, she and two other Nighthawks, which apparently were called by her alarm, circled me repeatedly in an effort to divert me from the nest. The following day, the female was found brooding the young nestling in the northeast corner of the building and the remaining egg was abandoned. The nestling was banded with No. 512-45999. The deserted egg was dissected and found to be in an early stage of development.

Efforts to capture the female parent with a drop trap failed because she repeatedly called the nestling out from under the drop trap where I had placed it, and continued to brood the young bird out of range of the trap. While this method of trapping was underway, two males remained on guard, perched on the walls and abutments of the roof, and repeatedly attempted to drive me away. One regularly returned to his roost on the TV antenna. On July 21 Clarence Owen and the writer captured the female parent with a mist net and banded her with No. 512-46000.

Analysis of part B of table I shows that this bird, unlike the previous female which had nested on the open roof, faced directly away from the sun 50% and generally away 25% of the time when observations were made. Only three times was she found facing directly into the sun. The response to sunlight in this case agrees with the finding of Weller (1958). The difference in direction of orientation between the two years may be explained by the higher temperatures in July compared to June. In an earlier paper (Dexter, 1956), I reported finding female No. 42-232611 facing into the corner where she was nesting, away from the direct rays of the sun. More often she was found, over several years time, facing away from the corner regardless of the direction of sunlight. Sutton and Spencer, (1949), reported the same experience. At nighttime the incubating female has always been found facing out from the corner of the wall. Female No. 512-46000 faced away from the breeze 36% of the time when under observation. This female, however,

nested close to a wall which gave her protection and interfered with the breezes. Only once was she found facing directly into the wind. Because of nesting close to a wall, her responses to wind direction are not as dependable as the case given in Section A of Table I.

SUMMARY AND CONCLUSIONS

I. A female Common Nighthawk banded (42-232611) on the campus of Kent State University, Kent, Ohio, June 7, 1950, and recaptured while nesting at the same place in 1951, 1953, and 1955, again returned for nesting in 1958 and 1959.

II. The mate of this bird was observed to incubate the eggs at dusk for an undetermined length of time. This was the first time the writer has observed a male Nighthawk incubating the eggs.

III. Unlike previous years this pair nested in 1958 on an open roof some distance away from any wall. Observation of the orientation of this bird to direction of sunlight and wind showed that during 80% of the observations, she was facing directly into the sunlight, and during 33% of the time observed she was facing in the direction of the breeze.

IV. For the first time since 1948 two pairs of Nighthawks nested on the campus in 1959. The new nesting female was banded with No. 512-46000. She laid two eggs close to a wall on the roof of Merrill Hall, but the eggs were not placed in a corner as had been the practice of the female which nested on the campus from 1948-1959. This new nesting female was found to face directly away from the sun 50% of the time observed, and faced away from the direction of the breeze 36% of the time under observation. This bird, however, was sheltered by a northeast-southwest wall which formed a barrier to many breezes. Only one of her eggs hatched. The second egg was deserted shortly after the first one hatched. Dissection showed the unhatched egg to be in a very early stage of development.

V. Observations on two incubating females showed that these birds usually orient according to the direction of sunlight. However, they do not always orient in the same manner. One female predominantly faced the sun while the other faced away from the sun over the greater part of time observed. Differences in temperature may explain the reversal of facing direction. In the absence of direct sunlight, the direction of the wind seemed to be of greatest importance in orientation. Here again, the facing direction is not constant, one bird predominantly faced the breeze directly, while the other more often faced away from the breeze. The latter bird, however, was protected by a north wall which interferred with many breezes. In cases of strong wind the incubating female always seems to face directly into it, and very strong wind is probably of more importance than direction of sunlight in determining orientation.

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MIGRATION OF THE COMMON COTURNIX IN NORTH AMERICA*

BY DAVID KENNETH WETHERBEE AND KARL F. JACOBS

The recent introduction to North America of some 172,000 Quail *(Coturnix coturnix)* from Japan is the most extensive attempt at introduction of an exotic game bird in recent years. This paper chronicles records of 143 banded recoveries of this species in North America taken prior to May 1, 1958 and recovered either more than 100 miles from point of release or 60 days subsequent to the release date. These birds were probably all descended from the same genetic stock of 140 breeders imported from Japan in 1953 by J. W. Steinbeck of Concord, California and propagated by various state game departments. Presumably all birds released were hatched in incubators and were artificially brooded.

Table 1. Common Coturnix releases and recoveries

Release Area	*Number Released*	*Band Returns**
Arkansas	1,633	10
California	5,066	1
Georgia	3,472	7
Illinois	1,700	3
Indiana	20,819	6
Missouri	23,745	6
Nebraska	23,740	20
Nevada	64	0
New Hampshire	2,000	0
North Carolina	1,196	1
Ohio	9,978	13
Oklahoma	61,277	53
Texas	9,600	5
Virginia	7,575	18
TOTAL	171,865	143

* Note: All band returns except nine resulted from releases made during 1957. The nine returns resulting from releases made during 1956 included four from Missouri, one from Illinois, one from Ohio and three from Virginia.

Geographic analysis: Because there appears to be some tendency for Common Coturnix released in North America to migrate in a converging

* This study is a contribution from Federal Aid to Wildlife Restoration Program, Surveys and Investigations Projects, Oklahoma W-65-R and Nebraska W-30-R.

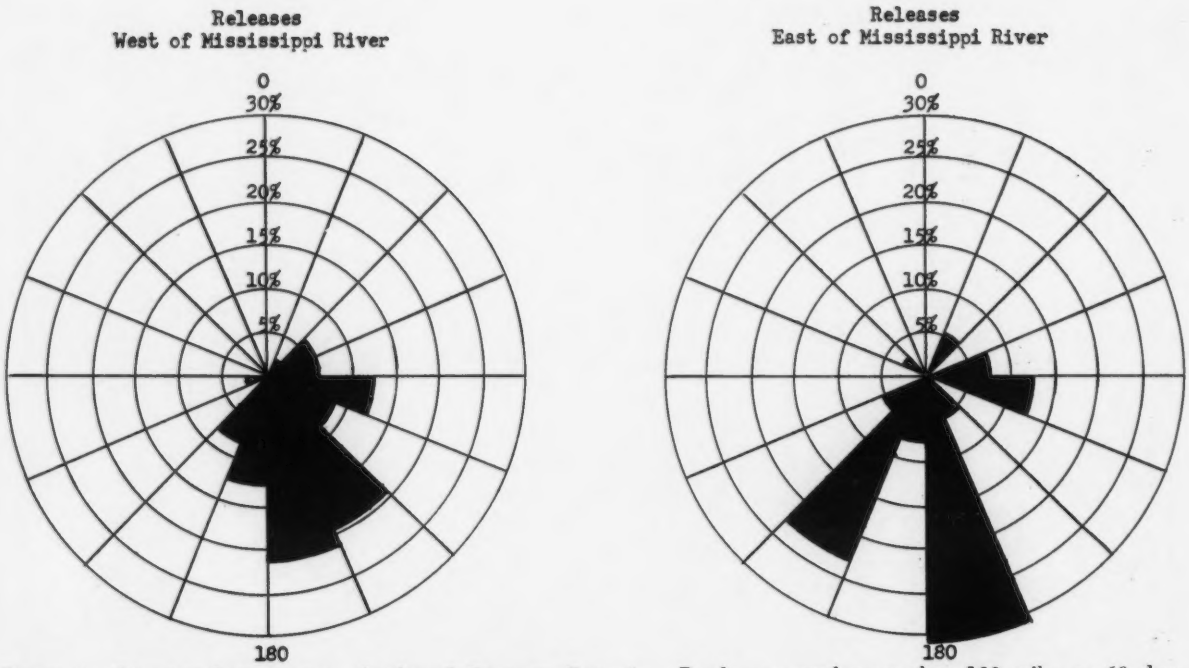


Figure 1. Directional movements of released Common Coturnix. Bands recovered more than 100 miles or 60 days from the point of release and shown in directional travel segments and expressed in per cent.

pattern toward the land areas adjacent to the Gulf of Mexico, the band return data have been separated into two sectors for geographic analysis. The Mississippi River was selected as the separation line between the east and west sectors. The apparent convergence might be the result of greater opportunity for western liberated birds to be recovered farther to the east than to the west or south of the point of release.

The number of birds released through May 1, 1958 was 171,865. Releases from the east sector totaled 44,804 and releases from the west sector totaled 127,061. The 14 states listed in table 1 and the State of Washington planned to release approximately 127,000 additional birds during 1958. At least three other states—Tennessee (Due and Ruhr, 1957), Louisiana and Kentucky—participated in the program but their data are not available.

The 143 returns that met the "60 day or 100 miles" requirements of this study represented .08 per cent of the birds released. Returns were further categorized in three groups on basis of travel distance, "0 to 10 miles," "10 to 100 miles" and "more than 100 miles." Individuals in the "0 to 10 miles" group were not plotted as to direction of travel; the other two groups were mapped and graphed.

The "more than 100 miles" group consisted of 60 per cent of all the returns. Recovery occurred at an average distance of 298 miles from the point of release. There was a definite trend toward a southward movement from the areas of release as well as a less pronounced movement eastward. When the east and west sectors in figure 1 are compared it is evident that some degree of convergence occurred during the general southward movement. The most pronounced direction of travel for birds in the western sector occurred between 135 and 180 degrees, whereas the direction of travel for birds in the eastern sector occurred between 157° 30′ and 225°. Southward movement was more pronounced in the east than in the west. A comparison of the returns of this long-distance group with the "10 to 100 miles" group indicated that directional stabilization occurred.

The "10 to 100 miles" group was plotted as to direction and distance of travel. This group consists of 21 per cent of all the returns. Recovery occurred at an average distance of 42 miles from the point of release. Movement to the south was not as pronounced in this group as it was in the "more than 100 miles" group. The average distance traveled was 71 miles for birds of this group in the east sector and 34 miles in the west sector. It is apparent that birds in this group in the east tended to move more continuously once they were out of the area of release than did the birds in the west.

The "0 to 10 miles" or sedentary group consists of 18 per cent of all the returns. Recovery occurred at an average distance of 1.3 miles from the point of release. This group was not plotted as to direction of travel as only four returns were taken out of the general release areas. No recoveries of sedentary birds were reported north or east of a line from Nebraska to Oklahoma and from Arkansas to Georgia (fig. 2).

Temporal analysis: While the numbers of records are insufficient to draw definitive conclusions, the records available suggest a migration pattern that fits rational expectations. The calendar date of release and

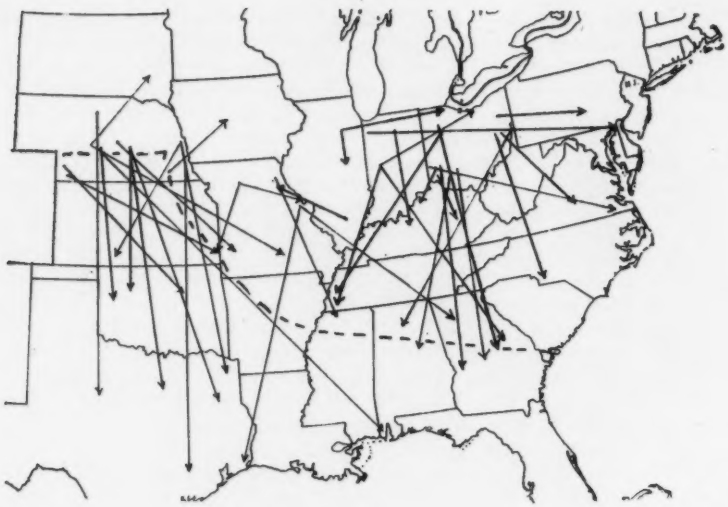
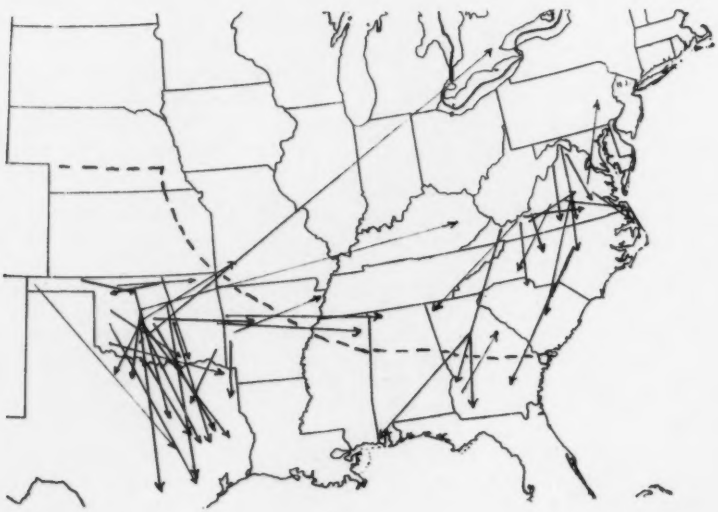


Figure 2a, b. Movements of released Common Coturnix. Broken line indicates the geographic limits of recoveries of sedentary birds.



the weather were the important factors determining recovery locations and numbers. Most of the birds perished from predation, starvation and exposure when introductions were attempted in the early spring before there was adequate cover. The Indiana to Maryland record cited below for a bird released in April may be regarded as the extraordinary alternative to such a fate. The records indicated that introductions made a little later in the spring either established themselves near the point of release or migrated north. An example of the latter is a bird released June 13, 1957 in Powhatan County, Virginia that was taken at Hamburg, Pennsylvania July 7, 1957; while another released as late as July 9, 1957 in Bourbon, Kentucky was recovered in Saginaw, Michigan about 107 days later (Stephens, ms.). Common Coturnix released in the summer in adequate habitat settled down to breeding. Undoubtedly the judicious selection of good season for making introductions was far more important for success than the number of birds released through the year. Subsequent recoveries revealed that July 17, 1957 was the optimum date for release in Nebraska. In late fall most hunter recoveries were taken south of their release points.

One bird released July 17, 1957 in Nance County, Nebraska was recovered alive March 11, 1958 in Hall County, Nebraska (Wetherbee, ms). As six other birds of this release group were taken during the winter in Oklahoma and Texas, and as there was an absence of winter records substantiated by specimens in Nebraska, the above unique recovery may be evidence of return migration in the spring.

Biological analysis: Our data indicate that the introduced Common Coturnix in North America does not generally emigrate southeast and perish at sea (Phillips, 1928). However, there is one record that should cause students to keep that idea in mind. A seven week-old male that was released in Morocco, Indiana, April 23, 1957 was recovered June 5, 1957 at Darlington, Maryland (see temporal analysis). It should be remembered, however, that the suggestion was first made on the basis of nineteenth century introductions of the European race (birds hatched in Europe), not of the Asian race (birds hatched in North American incubators). The slight southeast vector in our data, it is to be noted, occurs at a latitude of prevailing westerly winds and on a land mass having southeasterly river drainage in the western (most heavily sampled) sector. There is less of a southeast tendency in the eastern sector, perhaps commensurate with the drainage influence in the eastern sector. The relative orthodoxy of migratory behavior in these introduced birds, and the paucity of fluky data are the more surprising as Moreau (1951), after intensive study in Europe, concluded that the patterns of migration of the European subspecies are probably not standardized even in the Old World.

The relatively low (.08 per cent) ratio of recoveries to birds banded is probably only partly a function of poor release techniques: in Japan, Austin and Kuroda (1953) reported a recovery of eight per cent from 12,554 native Common Coturnix banded over a twelve-year period. Toschi (1956) recovered one per cent of half a million Common Coturnix banded, transported from points of capture and then released on hunting areas in Italy. It is not to be assumed that the bias in Toschi's data is any less than in our own for our data are further restricted to recoveries made more than one hundred miles or sixty

days from point of release. The percentage of band recoveries in North America is relatively excellent even though it may seem to be small in an absolute sense. Returns from all large scale releases of hatchery-produced Bobwhite *(Colinus virginianus)* (Buechner, 1950) are comparable to our returns of the Common Coturnix. For example, Hanson (1947), summarizing the data on Bobwhite restocking in Oklahoma for the period 1942-1946, reported 1.26 per cent of 57,062 released birds were recovered. The comparison is still more favorable when one considers that the Bobwhite is sedentary and is selectively hunted while the Common Coturnix is migratory, frequents large expanses of open grassland and is not selectively hunted.

A potentiality of a consolidation of the artificially sustained population is suggested by the recovery at the same site in Oklahoma, in late fall, of a Common Coturnix released in Nebraska in July and one released in Oklahoma in August.

Most birds recovered were shot by sportsmen. Other decimating agents, especially near the sites of release, included hawks, crows, strung wires and harvest machines. The summarization of recoveries as early as a year after release date is possible because of the almost complete population turnover each year. The accelerated life history of this species causes the Common Coturnix to have perhaps an even more rapid population turnover than does the Bobwhite and suggests the possibility of extreme fluctuations in population levels if the introduction is a success in this country. In Japan, Austin and Kuroda (1953) found that ninety per cent of the recoveries of native Common Coturnix were taken within the first year after banding. Catastrophic population crashes have been experienced in England and the subsequent comeback is slow (R. E. Moreau, personal communication).

It may be ten to twenty years before an adequate evaluation can be made of the ultimate biological success of the Common Coturnix in North America. This *Drosophila* of the avian laboratory has proved its worth as a laboratory pilot animal in genetic and physiological study. Therefore escaped birds will continue to be observed even should deliberate introduction stop. Most agencies plan a respite in making liberations after the 1959 season.

Summary: Records of 143 banded recoveries of artificially propagated Common Coturnix in North America suggest that that species probably will have an orthodox north-south migratory behavior on this continent if naturally breeding populations can be established. The rapid population turnover suggests extreme fluctuations in population levels, and the necessity of wide geographic range and close management if the introduction is to be a success in North America.

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SOME INSECT PARASITES ASSOCIATED WITH THE EASTERN BLUEBIRD IN MICHIGAN

EUGENE E. KENAGA

Birds are known to have many external and internal parasites which may effect their health and numbers. O. E. Plath (1919) mentions two species of blowflies *(Protocalliphora avium* and *P. splendida)* the larval stages of which are external blood-sucking parasites of nestling birds. He studied 63 nests of five species of birds in western United States and found 39 were infested, often causing the death of the nestlings.

Boyd (1951) states that blowfly larval parasites of birds are typically nocturnal and feed intermittently. Mud constructed nests and nests in holes are favorable abodes for parasitic *Protocalliphora*, for the life cycle may be passed within the nest itself. Death of fledglings from such infestations has been frequently reported.

Sabrosky and Bennett (1956) recognize 21 Nearctic species of *Protocalliphora*, 13 species of which were found in Algonquin Park, Ontario. *Protocalliphora metallica* and *P. sialia* are the only forms definitely known by Sabrosky (1959) to occur in Michigan, although based on general distributional records at least eight other species seem likely to be discovered in this state.

In the Midland area, from 1956 to 1959, I have banded 61 Eastern Bluebird *(Sialia sialis)* nestlings and adults from nests. Not until 1959 did I find any larva of *Protocalliphora* actually feeding on the birds. On these occasions the birds were examined at twilight, indicating the nocturnal habits of the parasitic fly larvae. Even then, only a few out of hundreds of larvae were feeding at any one time, the rest being an inch or 2 away in the bottom of the nest, often out of sight, and nearly or completely engorged with blood.

In 1959 I found eight bluebird nests in the Midland area, of which four were successful. A few "case histories" of successful nests will illustrate the magnitude of the parasitic insect population of *P. sialia* maintained by bluebirds:

Stowe bluebird house. This box was 5 feet off the ground, on a fence post in a pasture. Chronological events are as follows:

June 7—5 bluebird eggs present.

June 19—5 nestlings about 2-3 days old.

June 26—Banded the nestlings and noticed 2 engorged maggots on each leg of one nestling; 1 maggot on the leg of another. Removed these maggots and 106 other pupae and maggots from the nest. Put insects in a quart jar at 80°F. in order to observe the development of the insects.

June 30—5 nestlings looked sick; cleaned out nest box and replaced bluebirds in a new nest artificially made of fresh hay; put all contents in the quart jar with the June 26th collection. A count of the parasites for June 26 and 30 totaled 206 larvae and pupae of *P. sialia.*[1]

July 6—In the holding jar, 15 adult *P. sialia* emerged from pupal cases.

July 13—There were no live adult blow flies in the jar. However, many small wasps, parasitic on the pupae of *P. sialia* emerged in the jar and were identified as *Nasonia vitripennis*[2] of the hymenopterous family Pteromalidae.

July 23—15 live adult wasps; no live adult blow flies in jar.

July 29—Some wasps in larval stage alive in fly pupae; no live adults in jar.

Aug. 7—No live adult blow flies or wasps. A count of the dead insects in the jar produced 146 life stages of the fly including 15 adults, 116 normal-sized pupae and 15 small pupae; plus 60 larvae too small to pupate which were dried up and difficult to find in the debris of the nest. Some of the small fly pupae contained wasp adults unable to emerge and one contained a dwarfed dead adult fly.

Kenaga Bluebird House. This box was about 6 feet from the ground, on a post at the edge of a shrubby pasture, about 2 miles northeast of the Stowe bluebird house. Chronological events are as follows:

June 13—6 nestlings; banded them.

July 6—2 nestlings left in the nest, both in very weakened condition; 1 remaining nestling had a fly maggot on its tarsis. Cleaned out contents of box; found 196 larvae and pupae of *P. sialia.* Kept these under observation in a jar as with Stowe bluebird box collection.

July 13—All bluebird nestlings gone from nest. In the jar, all fly larvae that were able had pupated; others dead.

July 14—3 adult flies alive in jar; numerous adult wasps *(N. vitripennis)* emerged; males about ½ the size of the females and with shorter wings.

July 16—2 adult flies alive; many adult wasps.

July 21—No adult flies alive; about 150 adult wasps alive.

July 23—2 adult wasps alive.

July 27—Hundreds of adult wasps alive.

July 30—Few adult wasps alive.

Aug. 3—No adult wasps alive.

[1]Identified from adults by Mr. Curtis Sabrosky, U. S. National Museum.
[2]Identified from adults by Dr. B. D. Burke, U. S. National Museum.

Aug. 5—Counted insect remains in nest debris and found 183 flies (8 were adults and 175 were pupae). At least 2 fly pupae contained live larval wasps or pupal wasps. There were approximately 2100 adult wasps, about 94% of which were females. In addition, there were 2 unidentified live adult fleas and one larva of the black carpet beetle, *Attagenus piceus* (a common household pest of woolen goods, feathers, etc.), and hundreds of unidentified non-parasitic mites.

During the summer of 1959, I found larvae of *Protocalliphora sp.* in the nest of several species of box-nesting birds, including the House Wren *(Troglodytes aedon)*, English Sparrow *(Passer domesticus)*, Tree Swallow *(Iridoprocne bicolor)*, Yellow-shafted Flicker *(Colaptes auratus)*, Eastern Bluebird and in the mud nests of the Cliff Swallow *(Petrochelidon pyrrhonota)*. The above species seem adjusted to the same nesting habitat. In the field study at Algonquin Park, Ontario (Sabrosky and Bennett 1956) over 2500 bird nests were examined. It was found that in general, species of *Protocalliphora* show a selective preference for certain habitat levels or strata. "Within a given habitat they will apparently attack any species of bird with young confined to a nest." Apparently the fly does not parasitize the adult bluebird. In 1960, in an area close by where bluebird nestlings were heavily parasitized, another pair of bluebirds, sitting on sterile eggs for a total of 46 days, remained completely free of *Photocalliphara* larvae.

Based on the data in the Kenaga bluebird house, the fly pupa takes about 8-10 days to emerge as an adult. In addition to the fly larvae, which parasitize the bluebird, there were at least 2 generations of wasps parasitizing the fly. According to Dr. Burks, *N. vitripennis* is a pupal parasite, ovipositing on the puparia within a quite narrow, critical time limit (Sabrosky 1959). The wasp appears to have a life cycle of about 12-14 days.

The Kenaga nest contained around 2300 insects dependent directly or indirectly on the bluebird nestlings blood. It is no wonder that bird deaths are often reported as the result of insect parasitism. Although I did not observe deaths to nestlings as a result of the above described parasitisms, a definite effect on the rearing time was noted. Six nestlings banded on June 13 in the Kenaga bluebird house were about 5-6 days old. Twenty-three days later (July 6), two nestlings were still in the box, making the rearing time well over 25 days. Bent (1949) states that the young remain in the nest 15-18 days. Thus, the 2 parasitized nestlings were retarded from leaving the nest by at least 10 days and possibly 14-15 days.

What effect does the parasitic wasp *N. vitripennis*, have on the population potential of *P. sialia*? Including the Stowe and Kenaga houses a total of 339 flies pupated, of which only 23 or about 7% emerged as adults. Thus, the wasp parasitism was heavy. The reproductive potential of a single pair of flies is probably several hundred eggs, so that if one assumes other survival factors to be favorable, this much wasp parasitism of the fly is not excessive for the survival of the fly species. Wasp parasitism of the fly comes too late to lessen the damage done by the fly larvae feeding on the bird, but is a significant factor in controlling the size of future generations of the blow fly.

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DISTRIBUTION OF WINTER REDWINGED BLACKBIRD POPULATIONS ON THE ATLANTIC COAST

BY BROOKE MEANLEY AND JOHN S. WEBB

The Coastal Plain Province of the Southeastern States is the principal wintering ground of Redwinged Blackbirds *(Agelaius phoeniceus)* that breed in the coastal marshes of the North and Middle Atlantic States, where they also form huge late-summer aggregations. The winter concentration area along the coast extends from about New York City to southeastern Georgia. Most of the Redwinged Blackbird population winters south of the mouth of the Chesapeake Bay, in the Middle and Outer Coastal Plain. In this Southeastern Coastal Plain area, U. S. highway 301 can be considered a tentative inland boundary, as far as significant numbers are concerned. Although appreciable numbers of Redwinged Blackbirds have been recorded during the winter in the southern Piedmont, and some in the southern mountain areas, *all* winter recoveries of birds banded on the breeding grounds and summer feeding grounds in the Northeastern and Middle Atlantic States have been east of the Fall Line, and mostly south of Chesapeake Bay.

Since 1957, the blackbird banding program of the Fish and Wildlife Service in the Eastern States has been accelerated, and the distribution picture may be somewhat altered when an appreciable number of additional recoveries have been made. It is expected, however, that the general pattern will be unchanged, for the moderate climate, bountiful food supply, and abundant protective roosting cover of the Coastal Plain south of the Chesapeake Bay apparently provide an optimum wintering ground.

POPULATION CENTERS

The important winter population centers south of Chesapeake Bay are, in order of relative abundance of birds: (a) the Virginia-Carolina Peanut Belt that extends from the Suffolk area of Virginia to Beaufort County, North Carolina; (b) the Lower Cape Fear River region; and (c) coastal South Carolina, from the Lower Santee River to southeastern Georgia.

In the Middle Atlantic States, the most important population center is in the Delaware-Chesapeake Bay region. In some years a secondary population center is near the coast along the Raritan River just south of New York City.

DISTRIBUTION OF ROOSTS

Most of the larger Redwinged Blackbird roosts are in the Virginia-Carolina Peanut Belt. Since the many flocks of Redwinged Blackbirds

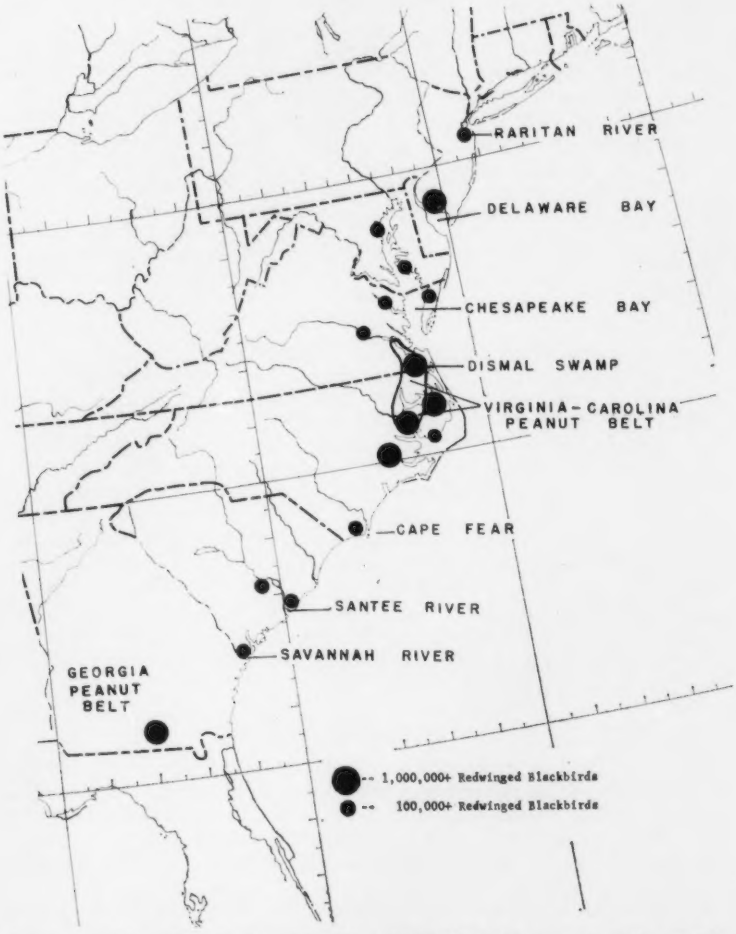

Figure 1. Winter Distribution of Redwinged Blackbird Roosts on the Atlantic Coast, 1957-1960. All large roosts contain mixed populations including Redwinged Blackbirds, Common Grackles, Cowbirds, Rusty Blackbirds and Starlings.

along the South Carolina and Georgia coasts are comparatively small and the roosts are small, it is likely that the total population is smaller than that of the Virginia-Carolina Peanut Belt.

The largest known winter roost is in the Dismal Swamp south of Norfolk, Virginia, near the Virginia-North Carolina line. The population in this roost is estimated 15,000,000 blackbirds, of which approximately 8,000,000 are Redwinged Blackbirds. Other large roosts located in recent years in eastern North Carolina are at Pinetown (4,000,000 blackbirds: 1,500,000 Redwinged Blackbirds); Columbia (2,000,000: 1,000,000); Trenton (2,000,000: 1,100,000); and Bolivia (200,000: 100,000).

North and south of the North Carolina Coastal Plain, smaller winter roosts are scattered through the tidal marshes. Most of these roosts are in the estuarine marshes along the lower reaches of coastal rivers near the upper limits of tidewater, where the taller fresh and brackish marsh plants are dominant.

The most important population center north of the mouth of Chesapeake Bay is the section of the Delaware Valley that includes the New Jersey Counties of Salem and Cumberland and most of Delaware. In January 1960, an immense roost containing an estimated 2,500,000 Redwinged Blackbirds was located at Artificial Island, Salem County, New Jersey.

BANDING RECOVERIES

Breeding Ground Derivation — R. T. Mitchell's analysis of recoveries indicates that Redwinged Blackbirds banded in eastern Canada, New England, and the Middle Atlantic States during the breeding season (April 16 to July 20) were recovered in winter (December 1-February 15) in states along the coast from the Lower Chesapeake Bay to Florida. Twenty-six out of 33 of the Redwinged Blackbirds recovered were near the coast between Norfolk, Virginia and Savannah, Georgia, mostly in the Carolinas.

Summer Feeding Ground Derivation — R. T. Mitchell's analysis of recoveries of Redwinged Blackbirds banded during the late summer feeding period (July 21-September 15) in the Northeastern States (north of Chesapeake Bay) and recovered on the wintering grounds between December 1 and February 15, reveals that 54 of 60 recoveries were made in the area between Norfolk and Savannah. Thirty-seven were from North Carolina.

FACTORS AFFECTING DISTRIBUTION

Blackbirds are diurnal migrants that naturally follow waterways and the coast line. It therefore seems plausible that the general north-south drainage system of the Coastal Plain Province of the Middle Atlantic and Northeastern States tends to funnel the blackbird population into the Dismal Swamp and Virginia-Carolina Peanut Belt south of the mouth of Chesapeake Bay.

Three other important factors that seem to influence the winter distribution of Redwinged Blackbird populations are climate, food, and roosting cover. All three are favorable in the Virginia-Carolina peanut belt and contiguous areas. Winter weather is generally mild,

and the interspersion of agricultural and forest land provides ample food and cover. In sections where there is more forest land than cultivated land, blackbird populations are sparser. This is true in much of eastern South Carolina and Georgia, where more and more of the land is being planted to pine.

During milder winters, a fairly large Redwinged Blackbird population is present in the Delaware Valley and Chesapeake Bay area. Corn left in the fields from mechanical corn picking probably is important in holding Redwinged Blackbirds this far north in winter.

CHARACTERISTICS OF ROOSTING COVER

Roosting areas of large aggregations of Redwinged Blackbirds usually are in wetlands and often are remote and inaccessible. In the main wintering grounds of the Atlantic Seaboard, roosts are in three principal cover types: Phragmites cane *(Phragmites communis)* and Big Cordgrass *(Spartina cynosuroides)* in the Delaware Valley-Chesapeake Bay area; swamps and pocosins in southeastern Virginia and eastern North Carolina; Giant Cutgrass *(Zizaniopsis miliacea)* and Big Cordgrass in coastal South Carolina and Georgia. The stands of Phragmites cane usually are found in tidewater, where the plants average 10 feet high and form dense cover. Big Cordgrass grows in brackish marshes, where it averages 7 feet high and provides good roosting cover.

The great pocosin swamps or bogs of the Coastal Plain section of North Carolina contain the most impenetrable thickets anywhere in eastern North America. The jungle-like aspect of these areas results from a dense undergrowth of shrubby broad-leaved evergreens mixed with catbriers *(Smilax laurifolia)*. Solid stands of Pond Pine *(Pinus serotina)* form the overstory. Most blackbird roosts are in this mixture of thickets and pines, although some are in the canebrakes *(Arundinaria)* of the same region.

Along the lower reaches of many of the Coastal Plain rivers of South Carolina and Georgia, Redwinged Blackbirds roost in small flocks in Giant Cutgrass. This plant forms extensive stands in the fresh tidal zone of the river estuaries, where it reaches 6 or 7 feet in height.

Although the principal winter Redwinged Blackbird roosts have been geographically located as depicted in Figure 1, others may exist in the rather extensive area of interest. Readers who know or learn of other roost locations are urged to contact the authors of this article.

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GENERAL NOTES

A Method of Recording Feather Molt in Birds.—While studying the molts in several species of birds, I was hampered by the tedious method of recording the stages of molt through which individual birds were passing. Taking written notes on feather loss and gain in several of the pterylae seemed to occupy too much time. In searching for a faster, more accurate method I came upon a process which may be of use to other banders.

I began by tracing several figures on an eight and one half by eleven inch piece of paper (Figure 1). The dorsal and ventral views of a Scrub Jay *(Aphelocoma coerulescens insularis)* by Pitelka (1945) show the feather tracts very well. The wings from Peterson (1947) are a bit small and should be drawn larger. The tail is just a schematic figure. From this sheet a stencil was cut and other copies were mimeographed. (The actual process I used was somewhat different and called multilith.)

Now, the procedure was somewhat simplified. The bird was examined for molt and those areas in molt were shaded in with a colored pencil. By varying the color, I was able to indicate old, molting, and new feathers. In the case of the retrices and remiges, a line showing the approximate length was drawn to scale on the diagram. If measurements of certain feathers were taken, the length was written "on the feather."

Other information such as date, weight, time, fat class, wing chord, etc., could be written or typed on the back of each sheet. These sheets in turn can be put in folders and stored in a standard sized filing cabinet.

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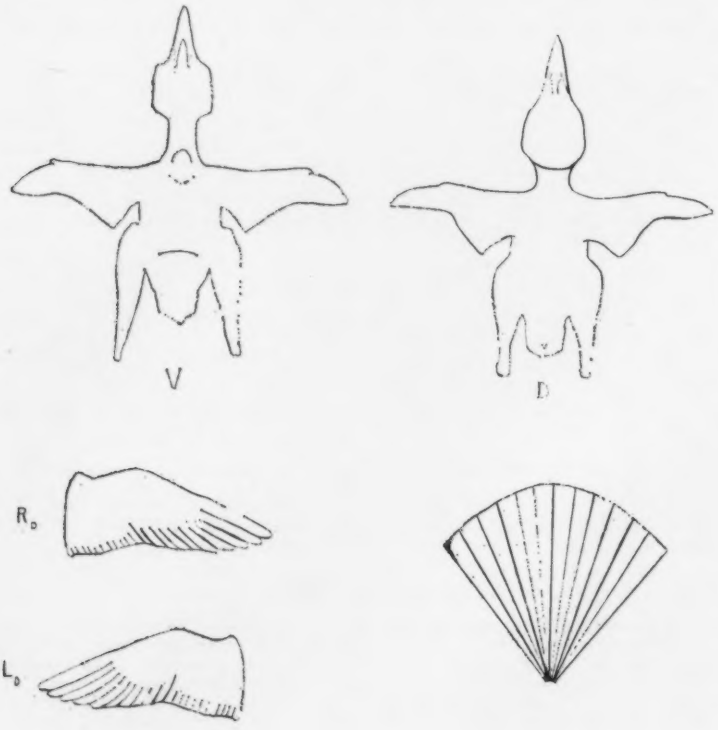

Descriptions of four artificially hatched, neonatal large-waders.—On July 5, 1958, O. L. Austin, Jr. and I took 4 clutches of eggs of 4 species of large-waders from a rookery near Gainesville, Florida. The eggs were put immediately into an incubator maintained at standard conditions of 37.8 degrees C., 64 per cent humidity, forced draft. The clutches were already partly incubated at the time of collection; hatchability was 100 per cent. One neonate of each species was contributed to the Florida State Museum.

These new descriptions supplement descriptions made previously of 3 other neonatal herons, *Butorides virescens, Botaurus lentiginosus,* and *N. nycticorax* (Wetherbee, Artificial incubation of wild birds' eggs and developmental condition of neonates, ms. University Microfilms, 1959).

Cattle Egret, *Bubulcus ibis.* A complete clutch had 4 eggs averaging 46.5 mm. x 34.47 mm. The eggs appeared larger and lighter in color than those of the following 3 species. Between the hatching of the first and last egg 79± 6 hr. elapsed. The weight of the chicks averaged 21.69 g. (20.35 g. to 22.48 g.). The eggs opened relatively near the small end compared to those of passerines. The chicks of the herons had white down that was conspicuously longer and stiffer on the head. Skin was blue-gray, lighter on apteria and conspicuously blue over the eyes, legs were flesh-color, nails white, bill and lores yellow-green with small orange fleck between the nares on the culmen and with a gray spot in front of the orange. The gular sac was also light orange, the tomium was blue-gray, the inside margins of both mandibles were gray as was also the tip of the tongue; the rest of the mouth was light pink.

The eyes were open and had irides of light yellow. The auditory meatus was conspicuous. The skin hung loosely above the heel. The chick, upon hatching sat up feebly and squawked while the head was raised shakily; the toes made grasping motions and the wings made swimming strokes.

Snowy Egret, *Leucophoyx thula.* A complete clutch of 4 eggs averaged 43.8 mm. x 31.6 mm. The eggs were the smallest of the species described here and the next to lightest in color. Between the hatching of the first and second egg 16± 6 hr. elapsed and between the second and third, 20± 3 hr. elapsed. The neonates averaged 16.66 g. (15.45 g. to 17.70 g.). The down was similar to that of *Bubulcus ibis.* The skin and the black-tipped bill were cinnamon. The toes were lighter buffy brown than the legs (which had a knicker-like edematic appearance), nails were light gray, feet relatively small. The mouth lining was dull flesh color.

Louisiana Heron, *Hydranassa tricolor.* The eggs from a complete clutch of 3 very light turquoise eggs averaged 42.90 mm. x 32.63 mm. Between the hatching of the first and last egg 60± 11 hr. elapsed. The neonates averaged 17.11 g. (16.00 g. to 18.27 g.). The scanty down was light tawny on the head, dark gray on the back and wings and white on the femoral tract and underparts. The skin was grayish flesh-color and the bill the same except gray at the tip and along the tomium; toenails were white, mouth yellowish pink.

White Ibis, *Eudocimus albus.* The eggs from a complete clutch of 3 eggs averaged 54.53 mm. x 39.63 mm. The chicks averaged 32.32 g. (31.20 g. to 34.20 g.). The natal plumage (5 mm. to 10 mm. in length) was blackish anteriorly and gray posteriorly. The dark down of the crown and cheeks presented a striking contrast to the bare orange facial region. The skin, mouth and bill were light pinkish orange except for the anterior thirds of both mandibles which were black. The toenails were light gray. Although the bill did not show the decurved feature of the adult it is interesting to note that the tip of the tongue was decurved. In general the newly hatched ibis chicks were more helpless than those of the herons (which had good muscular control) and had a cormorant-like appearance. They uttered successive short rasping calls.—David Kenneth Wetherbee, U. S. Fish & Wildlife Service, Massachusetts Cooperative Wildlife Research Unit, University of Massachusetts, Amherst, Massachusetts.

Tree Sparrow Recovery.—A Tree Sparrow *(Spizella arborea)* was banded at Arcadia Wildlife Sanctuary of the Massachusetts Audubon Society in Northampton and Easthampton, on February 13, 1958, with band 53-94075. It repeated on February 15, and March 8. Essentially one month later, on April 7, 1958, this bird was trapped and released by Mr. Victor R. Perkins, assisted by Miss Virginia Perkins, at Maple Valley, Bethel, Vermont. According to the records, this Tree Sparrow took about a month to travel the approximately 110 miles from the Arcadia station (coordinates 4217-7238) to Bethel, Vermont. The time of

leaving is of interest, inasmuch as there now seems evidence that northerly migration may begin for this species and other far-north nesters around mid-March, the picture usually being confused by accretions of birds which have wintered at more southerly points.—Edwin A. Mason, Arcadia Wildlife Sanctuary, Easthampton R.F.D., Mass.

RECENT LITERATURE

BANDING

1. Banding activities at Falsterbo Bird Station 1957-1958. Report No. 17. Ringmärkningsverksamheten vid Falsterbo fågelstation 1957-1958.) Bengt Fritz and Roy Nilsson. 1960. *Vår Fågelvärld*, **19:** 208-220. (English summary.) During the two years 7,798 birds of some 80 species were banded. Through a grant from the state and contributions from clubs, two new traps (one Heligoland type) and a number of mist nets were added to previous stock of equipment. In these, 11 species new for the station were caught, including such birds as Hawfinches *(Coccothraustes coccothraustes)*, Redpolls *(Carduelis flammea)* and Willow Tits *(Parus atricapillus)*. At one time, an on-the-spot Sparrow Hawk *(Accipiter nisus)* grasped the station's first Linnet *(Carduelis cannabina)* "almost out of the hands of the bander." Recoveries amounted to 106 birds. The most remarkable of these was the Redstart *(Phoenicurus phoenicurus)* which was banded 23 Sept. and 31 days later found dead on board a ship halfway between the Canary Islands and Florida. Lists of the birds banded and recoveries complete the report.—Louise de K. Lawrence.

2. Report on Bird-Ringing for 1959. Robert Spencer. 1960. *British Birds, Ringing Supplement* **55:** 457-502. A total of 242,325 birds were ringed in Great Britain in 1959, an increase of more than 41,000 over 1958. A gratifying feature is the large proportion of nestlings—28.6 percent—banded. "Colonial seabirds such as Herring Gull and Sandwich Tern contribute greatly to this, as do Blue Tit and Great Tit." Other species of which from 2,051—3,849 "nestlings" were ringed were Manx Shearwaters, Lapwings, Blackheaded Gulls, and Swallows *(Hirundo rustica)*. A total of 6,949 birds were recovered during the year; 35 pages are devoted to reporting the most significant of these. The British are certainly to be congratulated on their zeal and efficiency both in ringing and for making their results available.—M. M. Nice.

3. Recoveries in Great Britain and Ireland of Birds Ringed Abroad. E. P. Leach. 1960. *British Birds, Ringing Supplement*, **55:** 502-512. In this selected list Miss Leach notes with pleasure the "emergence of an organized ringing effort in the Iberian peninsula, a region of so much importance as a migration route." Goldfinches *(Carduelis carduelis)* ringed in Spain and Portugal are now being taken in Great Britain. "Once more there is evidence of an impressive invasion of young gulls—Great Black-backed and Herring as well as Common—from the U.S.S.R. in addition to Scandinavia, while a Herring Gull hatched in Ushant, France, arrived here from the opposite direction."—M. M. Nice.

MIGRATION

4. Bird tragedy at the dunes. Simon Sigal. 1960. *Indiana Audubon Quarterly*, **38**(2): 23-25. A severe storm, with winds of hurricane velocity and scattered hail, struck lower Lake Michigan at 10 p.m., 16 April, 1960. Subsequent surveys along 10½ miles of the southern shoreline produced a count of 3636 drowned birds of 56 species. The list included 1039 Slate-colored Juncos, 141 Yellow-bellied Sapsuckers, 32 Henslow's Sparrows, 25 White-throated Sparrows, 21 Brown-headed Cowbirds, 2 Screech Owls, and 2 Bluebirds.

Mass drownings of this sort are recurrent events over the Great Lakes. They help us to guess which species are predominantly nocturnal migrants and which are not. Their testimony differs substantially from the evidence supplied by TV kills, in which fringillids like the Slate-colored Junco, a leading subject of experimental research on migration, have been poorly represented. The data, however, are not absolutely conclusive. The possibility exists that diurnal migrants may find themselves over water at nightfall and thus be forced to continue flying after dark. Such birds, presumably, would be less adept at night flight than habitual nocturnal migrants and might die in higher proportion for that very reason.—R. J. Newman.

5. More TV tower destruction. Charles A. Kemper. 1959. *Passenger Pigeon*, **21**(4): 135-142. When a bird has met death by colliding with a stationary obstacle, the probability that it was a true night migrant is naturally much stronger than in the case of a bird that has drowned in a large lake. Yet even then the evidence falls short of unquestionable proof, as the present remarkable account shows.

When the station engineer arrived at the WEAU television installation at Eau Claire, Wisc., just before daybreak on October 1, 1959, he saw no dead birds. At 8 a.m. he noticed a great many. Dr. Kemper later estimated approximately 1200 casualties, 821 of which he and his helpers picked up, in addition to two red bats *(Lasiurus borealis)*. His report emphasizes his conviction that most of the victims must have crashed into the tower in daylight. Unfortunately some crucial information, such as the amount of illumination at the time the engineer saw no birds, remains unstated. The paper goes on to speculate that the earth's magnetic lines may "converge about any tall object in the air" and that perhaps "birds and bats are sometimes sleeping in their flight, drifting along magnetic lines like an airplane following a radio beam." Taking note of the well-known echo-sounding abilities of bats, it asks, "can any other theory explain why bats should collide with a tower?" The reviewer would answer yes. One simple possibility is that migrating bats traveling at high elevations, where there are no *natural* obstructions, do not try echolocation. At any rate, the premise that the earth's magnetic lines converge on tall objects seems likely to receive little support from physicists. Likewise the premise that migrants might drift along magnetic lines half asleep in flight will strike most ornithologists as fantastic.

A table compares the recorded species composition in the October 1959 disaster with the recorded results of four previous kills at Eau Claire including the worst tower catastrophe on record (see *Bird-Banding*, **29**(4): Review 7). Valuable as these data are, they have an element of avoidable uncertainty, one rather frequent along tabulations from television towers. Large numbers of the dead migrants at Eau Claire were neither retrieved nor identified, but the account does not specify whether the method used in collecting the portion retrieved and listed was in any way selective. Therefore the future user has no assurance that the data provide a random sample even for the kills themselves. Also worthy of comment is the problem of ambiguity in dating. Should one refer to a nocturnal disaster by the date on which the dark period ended or by the date on which that period began? Practice varies. In fact, a collision dated 29 August, 1959 in Kemper's text appears in his own tables under the heading "Aug. 28." One general solution to the problem of dating would be to designate each dark period by both of the dates that encompass it, e.g., *the night of April 29-30*. —R. J. Newman.

6. Studies in visible migration at Falsterbo Bird Station. Staffen Ulfstrand. 1960. *Bird Migration*, **1**(4): 183-187. The present paper is mainly a brief review of previously published reports on autumn observations of diurnal migration at the bird station on the Falsterbo peninsula in southwestern Sweden. The topics touched upon include the importance of leading lines in hawk migration in southern Sweden, the influence of wind on the effectiveness of these leading lines and on the course of migration, and the year-to-year variation in the numbers of migrants and the timing of the big flights. Appendices list the publications with information on bird studies made at Falsterbo.—Stuart L. Warter.

7. Birding on the Ocean. Alfred O. Gross. 1960. *Audubon Magazine*, **62**: 274-277, 298-99, 310. November-December, 1960. A round-the-world trip by freighter yielded a number of records of land birds well at sea. On 10 November, 1957, at Latitude 40° 18′ north and Longitude 70° 10′ west, about 175 miles from New York, a Rusty Blackbird *(Euphagus carolinus)* reached the ship, with no sign of exhaustion. A Mourning Dove *(Zenaidura macroura)* spent about an hour on the ship and then flew off. Then a number of sparrows arrived, in good condition: three Slate-colored Juncos *(Junco hyemalis)*, one Savannah Sparrow *(Passerculus sandwichensis)*, one Grasshopper Sparrow *(Ammodramus savannarum)*, two Vesper Sparrows *(Pooecetes gramineus)*, and one Song Sparrow *(Melospiza melodia)*. A steady northwest wind blew at 20 to 25 miles an hour.

On 11 November, a Sparrow Hawk *(Falco sparverius)* lit on the ship at 40° N. 62° 53′ W., about 500 miles east of New York, remained about half an hour, then flew off to the south. On 12 November, at 39° 39′ N. 54° 51′ W., a male Snow Bunting *(Plectrophenax nivalis)* flew about the ship, apparently in good condition. On 13 November at 39° 27′ N. 46° 26′ W., about 1,269 miles from New York and 908 miles from the Azores, a female White-winged Crossbill *(Loxia leucoptera)* flew about, and then flew off to the southwest.

A Blackpoll Warbler *(Dendroica striata)* was first noted on 14 November, but was reported to have come aboard soon after the ship left New York. It spent most of its time in the warmth of the engine room, and was fed by the men. It regularly got water at a dripping faucet. The bird left the ship at the Azores, after a ride of 2,177 miles from New York, vividly illustrating how some of the many casual visitors may reach these remote oceanic islands.—E. Alexander Bergstrom.

8. Autumn "Drift-migration" on the English East Coast. David Lack. 1960. *British Birds*, **53**(8); 325-352; (9): 379-397. An analysis of the records from 1949-1959 of three English east coast observatories of the arrivals of night migrant chats (Turdinae except the genus *Turdus)*, warblers (Sylviidae) and flycatchers (Muscicapidae). "Most big and moderate arrivals occurred with an anticyclone in Scandinavia and strong south-easterly winds in the southern North Sea, but others took place in a variety of different conditions, a few with westerly winds throughout the North Sea." The most important factors were those influencing the proportion of migrants alighting on the English coast. "Alighting is probably favored by head-winds, strong cross-winds, rain and full overcast."—M. M. Nice.

POPULATION DYNAMICS

9. The Scottish Mute Swan Census 1955-56. C. P. Rawcliffe. 1958. *Bird Study*, **5**(2): 45-55 and p. 218. At the beginning of the 1955 breeding season 925 adults and 2128 non-breeders were recorded. The success of the census of 1955 and the breeding bird census was considered moderate. Actual population may be 3500-4000 swans. The non-breeders are largely in herds. Although the observed cygnets are recorded, there are no estimates of nesting success.—C. H. Blake.

10. The National Census of Heronries in Scotland 1954 with a Summary of the 1928/29 Census. Elizabeth A. Garden. 1958. *Bird Study*, **5**(2): 90-97. In 1954, 1086 nests were reported from 177 heronries of *Ardea cinera*. Almost half these heronries were first reported in 1954. The birds have increased to the north and decreased in southern Scotland without an evident decrease in adjacent England. Egg-stealing by *Corvus corone* appears to be a major predation.—C. H. Blake.

11. The Census of Heronries 1957. J. Stafford. 1958. *Bird Study*, **5**(3): 121-125. The British population of *Ardea cinerea* may be the most consistently censused of all nongame birds. In 1957, 271 heronries (about half of those known) were counted and contained 4140 nests or nearly 16 per heronry compared with 6 per heronry in the 1954 Scottish census. Using only heronries counted in both years, nest count increased nearly 7 percent in 1957 over 1956

but was 8½ percent below 1954. Nearly identical results are obtained by comparing the reports for those counties in which all known heronries were censused. —C. H. Blake.

12. The Great Crested Grebe Sample Census 1946-1955. P.A.D. Hollom. 1959. *Bird Study*, **6**(1): 1-7. *Podiceps cristatus* were counted on bodies of water, not on nests. Two comparisons show populations in 1953 increased 15-16 percent over 1952, and in 1955 decreased 10-11 percent from 1954. Desertion of old waters and colonization of new ones shifts 2 to 3 percent of the population each year. Also, there is evidence of a considerable transfer of population from south to north. New waters may achieve a large population without lowering that of the surrounding area. It is not known at what age the species breeds nor anything about its site tenacity.—C. H. Blake.

13. The Census of Heronries 1958. J. Stafford. 1959. *Bird Study*, **6**(4): 175-179. This year 220 heronries contained 3377 nests or just over 15 per heronry. As in previous years a few new heronries were found. For those counted in both 1957 and 1958, the number of nests decreased 9.9% in 1958. A similar comparison with 1954 shows the 1958 count down 16.6%. This agrees well with a comparison between the most thoroughly covered counties.—C. H. Blake.

NIDIFICATION AND REPRODUCTION

14. Pine Grosbeak breeding in outdoor cage. (Konglebit *(Pinicola enucleator)* hekker i friluftsvoliers.) A. Bernholft-Osa. 1960. *Vår Fågelvärld*, **19**: 220-223. (English summary.) The pair, which spent the winter in the cage, began singing early in the spring. By the end of May they completed the nest and laid a clutch of 3 eggs, of which 2 hatched and 1 was infertile. The male fed the female on the nest, as he had done during the courtship period, but gave her no assistance either with building the nest or with incubation. Incubation began with the laying of the third egg and lasted 12 days. Nest life lasted 14 days. The young were fed animal and vegetable foods by regurgitation. After fledging, when the male took over most of the feeding, the female made a second and a third nesting attempt, both abortive. This suggests that the species is double-brooded. One of the young survived to adulthood, a male which began singing in February the following year.—Louise de K. Lawrence.

15. Statistical Analysis of Marchant's Data on Breeding Success and Clutch Size. Monte Lloyd. 1960. *Ibis*, **102**(4): 600-611. S. Marchant *(Ibis* **102)** kept careful records over four years (1955-1958) of numbers of nests, clutch size, and breeding success in southwest Ecuador. He concluded that 1956 would be the worst year for clutch size and general success, with no difference between 1955 and 1957 for breeding success. On the basis of such general comments by Marchant, Lloyd set up five independent pairs, each consisting of a null hypothesis and its alternate. The important points are that these are *carefully stated* pairs of *independent hypotheses*. The test used (Cochran, *Biometrics* **10**: 441) appropriately weights the data on the 20 species with sufficiently large amounts of data. The proportion of nests in which eggs were laid but no young fledged was not significantly greater in 1956 than in the other years combined (contrary to Marchant's expectation). In 1958, a year of abundant predatory snakes, total losses of eggs were significantly high as well as total losses of hatched young. Consonant with an hypothesis of predation partial losses of eggs or young were not significantly higher.

There is evidence, not formally tested for, that the poor, short 1956 season totally inhibited the breeding of several species. Clutch size was not clearly diminished in 1956. Other subsidiary hypotheses suggested by the analysis and Marchant's conclusions are also tested. Lloyd makes an interesting distinction bewteen the bird that does what it sets out to do and the bird that does not, even though the second bird with a partial loss may actually produce more young than

the first bird with complete success. Over-all predation and not weather produced excess losses. The paper should be "required reading" for anyone concerned with nesting data.—C. H. Blake.

16. The post-fledging mortality of the Kittiwake. J. C. Coulson and E. White. 1959. *Bird Study*, **6**(3): 97-102. It is shown that earlier estimates of mortality included the mortality of the bands. These lost 9.3 percent of their initial weight per year and became "illegible" after 4 years. Considering the strong site tenacity of *Rissa*, it can be fairly assumed that any breeder not appearing in its colony has died since the last breeding season. The average annual mortality of the adults thus shown is 12.4 percent from 1 May to 30 April following. The expectation of further life is 7.6 years. As the females do not breed until 3 or more years old, the breeding birds have an average longevity of 10½ years or more. A single capture-recapture experiment at the Farne Islands yielded an adult mortality of 7 percent. By using recoveries for the first 2 years after fledging only and assuming adult mortality in the second year, the mortality in the first year is 21 percent. The rate of increase of an isolated colony confirms the first breeding at 3 to 4 years of age.—C. H. Blake.

17. The Breeding Biology of the Shag *Phalacrocorax aristotelis* on the Island of Lundy, Bristol Channel. Barbara Snow. 1960. *Ibis*, **102**(4): 554-575. The species usually begins to breed when 4 years old, rarely at 3 years. On Lundy the population is relatively static, 120 to 132 nests in 1954-57. Nest site selection is by the male who returns to his previous site. New sites are chosen by new breeders. Abandonment of nest sites gives about 12 percent annual mortality for adult males; year to year recapture indicates 7 percent for adults at the prime of breeding. Little mortality occurs during the breeding season. New sites that do not produce young are not reused the next year. In successful sites the half-grown young are not subjected to prolonged drenching by spray.

The mean clutch is 3.07 eggs. Incubation period is 30-31 days. Hatching success varies from 69-73 percent, but is considerably lower at new sites. Young leave the nest at an average age of 53 days. The difficulty of feeding small hatchlings may be a major cause of death. Starvation, especially in the first 10 days of life, seemed to be common. Falling or being kicked from the nest was also significant. The mean production of young in 4 years was 1.87 per pair per year. The young appear to be still dependent on the parents at 100 days old and have then attained adult weight.

This study was carried through four seasons and part of a fifth. Hence, the first young produced were just beginning to breed. Much has been learned, but more would have been if the program had been set at the beginning to cover at least 10 years with provision for consistent methods even if the personnel changed.—C. H. Blake.

18. The Nesting Success of the Heron *Ardea cinerea* in Relation to the Availability of Food. D. F. Owen. 1960. *Proceedings of the Zoological Society of London*, **133**, Part 4: 597-617. A detailed study for six years at three heronries of the Gray Heron in southern England. Breeding started earlier in early springs, later in late springs. Size of clutch varied little, but survival of young differed markedly. When food was plentiful parents were able to raise all the young, but in bad years the youngest one or two birds died. The kind and relative numbers of prey species are analyzed, and weekly weights are given for 9 broods consisting of from 1 to 5 nestlings.—M. M. Nice.

BEHAVIOR

19. Biophysics of Bird Flight. August Raspet. 1960. *Science*, **132**: 191-200, 13 figs. This important and informative article is based on measurements made while following birds (*Coragyps atratus*, except in one case) with a specially instrumented glider. The results are quite superior to anything ob-

tained with models or frozen birds in a wind tunnel. Birds seem to be as good or better than airplanes within their limits of speed and loading. Evidence shows this is caused partly by extremely low drag or, what is essentially the same thing, low skin friction above a certain minimum speed. The author quotes an observation by Loughheed that the porosity is much greater for downward flow through the wing than for upward flow. He found that sucking some of the boundary layer down through the upper face of a glider wing reduced the drag. The Armed Forces have been experimenting along this same line recently to develop low drag airfoils.

Since the data in the article cover all the significant aerodynamic characteristics of the Black Vulture, the reviewer looks forward to a detailed comparison with a theoretical calculation of them. His first approximation is not too far out. Note that some curves the author calls "polars" are also called hodographs. The abscissae of Fig. 9 are "Mean Reynolds Number x 10^{-6}" as confirmed to me by Dr. D. F. Farrar, Jr. The author makes a significant distinction between "soaring," in which the primaries are separated at their tips, and "gliding" with the tip slots closed. The two hodographs intersect at 38 mph forward speed. Above this speed gliding yields a lower rate of sink for a given horizontal speed than does soaring. The bird generally chooses the mode with the lower relative rate of sink.

Two other important points are made. First, when soaring, the span efficiency factor of *Coragyps* is close to unity, which is its limit. Second, longitudinal stability (control of pitching movements) is partly obtained by shifting the aerodynamic center of the wing by changing its sweep forward or backward. The author is not at his best in considering energetics. He does not draw the necessary distinction between power output for a brief period during takeoff and the much lower continuous output possible. The reviewer also holds that the tail in most birds, but probably not in *Coragyps*, is the main source of longitudinal stability and that in landing it acts largely as a brake, contributing drag rather than lift.

Raspet refers to the small amount of theoretical work on flapping flight. It is pointed out that the great effective diameter of the bird wing as a propeller could produce relatively great efficiency at low speed. This idea was actually made use of by Otto C. Koppen in designing the "Helioplane" which has remarkably low take-off and landing speeds. One set of calculations the reviewer made of the efficiency of the bird wing as a propeller showed it to be above 90 percent. It is also intuitively true that the use of the wings as a propeller cannot noticeably impair their simultaneous function as airfoils. Finally the bird can alter both the pitch and the twist of its propeller, which helps maintain high efficiency over a wide range of flapping rates.

The author was killed in a glider accident in April 1960, but fortunately his work is being carried on by others.—C. H. Blake.

20. Experimental Investigation of the Behavior of Certain Passerines during the Nesting Period by Means of Natural Stimuli. E. K. Vilks. 1958. *Akademiya Nauk Latviyskoy SSR.* **6:** 177-186. Translated from Russian by David Nichols, 2373 Woolsey St., Berkeley 5, Calif. $.25. One set of experiments involved changing stimuli to later stages in the nesting cycle: 40 substitutions of nestlings for eggs and 24 substitutions of older nestlings for younger ones. If eggs had been incubated for 1-2 days the parents started immediately to care appropriately for the young. When older young were introduced into a nest feeding at once increased in frequency. In 17 cases young were replaced by eggs or younger birds. Pied Flycatchers *(Muscicapa hypoleuca)* returned to incubation after the removal of 2- and 4-day-old young. If nestlings of the Spotted Flycatcher *(M. striata)* less than 7 days of age were exchanged for younger birds, brooding was at once resumed; with a series of such exchanges brooding was extended to more than 25 days. "When the exchange was made for seven-day (or older) nestlings, the brooding reflex in none of our experiments returned and the nestlings died (unless the experiment was terminated in time.)"

If, however, the nestlings of these flycatchers and of Great and Crested Tits *(Parus major, P. cristatus)* were removed at 8 days and "were several times replaced with young birds," so that the nestlings apparently "remained at one and the same stage," after 2 or 3 substitutions parental feeding dropped dras-

tically and the young died. "Male flycatchers always reacted to destruction of the young by singing after a lapse of only a few minutes."

In three experiments where Pied Flycatchers were presented with two nests inside the nest box both containing eggs, both were "abandoned and covered with new nest material." Incubating female flycatchers preferred nestlings placed alongside their eggs, and parents deserted 1- and 2-day nestlings in favor of 6- and 7-day young. Thus the birds responded to the stronger of external stimuli. Very interesting work.—M. M. Nice.

21. Observations on Avadavats and Golden-breasted Waxbills. Derek Goodwin. 1960. *Avicultural Magazine*, **66:** 174-199. Delightful account of behavior of Avadavats or Strawberry Finches *(Amandava amandava)* from India and Golden-breasted Waxbills *(Amandava*, formerly *Estrilda, subflava)* from Africa. Mr. Goodwin describes happenings which well illustrate "the intense personal likes and dislikes of passerine birds." He discusses food preferences, food-begging of the young, courtship displays, nesting and parental behavior, and voice, and he provides telling sketches. "Mutual preening" . . . "involves sublimated (and not always completely sublimated!) aggression on the part of the preener and submission on the part of the preenee."—M. M. Nice.

22. Disturbance of the Mother-Child Relationship in Turkeys through the Loss of Hearing. (Störung des Mutter-Kind-Beziehung durch Gehörverlust.) Wolfgang M. Scleidt, Margret Schleidt, and Monica Magg. 1960. *Behaviour*, **16:** 254-260. Eleven *Meleagris gallopavo* poults were deafened between the 2nd and 8th days by removal of the ductus cochlearis or the columella. Deafened poults were more dependent on the caretaker than were the controls. Two deafened poults became adult; they incubated normally but consistently killed their poults as they hatched. The mothers could not hear the poults peeping and evidently treated them as nest enemies.—M. M. Nice.

ECOLOGY

23. The Dynamics of Insect and Bird Populations in Pine Woods. L. Tinbergen. 1960. *Archives Néerlandaises de Zoologie*, **13**(3): 259-473. From his boyhood Luuk Tinbergen devoted himself to ecological studies especially on birds; his death in 1955 was a severe loss to ornithology. In 1946 he had started his study on the influence of song birds on insect populations in the Hulshorst woods, paying particular attention to insect populations commonly used as prey. The present volume consists of five papers resulting from this study by Dr. Tinbergen, his colleagues, and his students.

The first paper—The Natural Control of Insects in Pine Woods. I. Factors Influencing the Intensity of Predation by Songbirds (pp. 265-343)—is by L. Tinbergen. Great and Blue Tits *(Parus major* and *P. coeruleus)* were induced to nest "in glass-backed nestboxes attached to a hide, where the birds could be observed at a distance of about 20 cm.," and the species and size of prey could be recorded. Exceedingly ingenious and detailed methods of counting the numbers of the populations of the different prey species were developed. It was found that when a prey population was low, predation was markedly low. "At moderate densities it is unexpectedly high, and at high densities it falls again below expectation." The suggested explanation is that "tits when searching for prey concentrate on one or a few species at a time, and that, by a kind of learning process, they adopt 'specific searching images' for these species." The lessened use of an abundant prey would seem to be due to the tendency of the birds to prefer a varied diet.

Part II of this paper—Conditions for Damping of Nicholson Oscillations in Parasite-Host Systems (pp. 344-379)—is by L. Tinbergen and H. Klomp. This is a highly technical discussion of A. J. Nicholson's (1933) theories, compared with the findings of these Dutch scientists. The authors conclude that "after modification of Nicholson's premises and after their adaptation to more natural

conditions many of his original ideas and starting points can be maintained and used in a working hypothesis."

Protection against Birds and Parasites in Some Species of Tenthedinid Larvae (pp. 380-447) by N. Prop analyzes the very low predation on sawfly larvae found in the first two papers in this collection. By means of exhaustive observations and experiments the author obtained very interesting results. Two gregarious sawfly species are able to intimidate approaching birds and parasites. All six species of sawflies possess a nasty resinous taste. The highly conspicuous gregarious species were attacked the least, the solitary, inconspicuous species were most attractive to their enemies.

Further Evidence for the Role of "Searching Images" in the Hunting Behaviour of Titmice (pp. 448-465) by J. H. Mook, L. J. Mook, and H. S. Heikens is a statistical study of the relationship of the Great Tit and the Bordered White Moth *(Bupalus piniarius)* in the Hulshorst woods; these "findings are in complete agreement with the results of the investigations of Tinbergen on other prey species."

Factors Governing Density in the Chaffinch *(Fringilla coelebs)* in Different Types of Wood (pp. 466-472) by P. Glas, shows that the Chaffinch population remained stable during a number of years in mixed woods, but fluctuated in pine woods, evidence that the mixed woods was the preferred habitat.

We owe a distinct debt to Drs. G. P. Baerends and L. de Ruiter through whose labors, as well as those of the different authors cited, these very valuable investigations were brought to completion and published in this notable volume.—M. M. Nice.

CONSERVATION

24. Initial Songbird Mortality Following a Dutch Elm Disease Control Program. Joseph J. Hickey and L. Barrie Hunt. 1960. *Journal of Wildlife Management,* **24**(3): 259-265. Although spraying was done on the campus of the University of Wisconsin and in a neighboring village during the dormant season, Robin *(Turdus migratorius)* mortality started about 15 days later; about 88 percent of the population was wiped out, as well as numbers of many other species. All this slaughter of our song birds is completely senseless, as *DDT does not save elm trees from Dutch elm disease.*—M. M. Nice.

25. Mute Swan in Närke, central Sweden, 1959. (Knölsvanen *(Cygnus olor)* i Närke 1959.) Nils Tarras-Wahlberg. 1960. *Vår Fågelvärld,* **19:** 227-235. (English summary.) This census was undertaken by aerial as well as field surveys. The first proved the most efficient. The importance of the reed *Phragmites communis* in the selection of breeding habitat was strikingly evident, since it is a prerequisite for the species as food and nesting material. In areas where this reed is scarce or absent, however, man's activities pouring his sewage into the lakes and lowering the water levels tend to improve living conditions for the Mute Swan and so prove to be a factor in the current increase noted of the swan population of this region.—Louise de K. Lawrence.

26. The status of certain rare woodpeckers in Sweden. (Iakttagelser av vissa sällsynta hackspettar år 1959.) Staffan Ulfstrand. 1960. *Vår Fågelvärld,* **19:** 223-226. (English summary.) The data were collected by questionnaire from observers all over Sweden. The species concerned were: the White-backed Woodpecker *(Dendrocopus leucotos)* found mostly in central Sweden and very rare there; the Middle Spotted Woodpecker *(Dendrocopus medius)* well established in the province Östergötland after an apparent northward movement; the Grey-headed Woodpecker *(Picus canus)* whose nest was found but which otherwise revealed no change in range or population density; and the Three-toed Woodpecker *(Picoides tridactylus)* whose appearance in more southern regions than earlier observed during the breeding season proved an interesting discovery. Irregular migrations, such as observed in North America, as a reason for the species' appearance in the south at that time evidently have hitherto not been noted by Swedish ornithologists.—Louise de K. Lawrence.

27. Ornithological observations at West-Spitzbergen summer 1958. (Ornitologiska iakttagelser från Väst-Spetsbergen sommaren 1958.) Sten Larson. 1960. *Vår Fågelvärld*, **19:** 193-207. (English summary.) Although the annotated list contains only 17 species, many interesting details of the behavior of these arctic birds on their breeding grounds lend original highlights to this report, most of which are covered by the English summary. Examples are: notes on the surprisingly successful defence activities of the Eider *(Somateria mollissima borealis)* against Glaucous Gulls *(Larus hyperboreus)*; on the rotating movements of the Gray Phalarope *(Phalaropus fulicarius)*; observations on the aggressive reactions of the Arctic Tern *(Sterna paradisaea)* especially in relation to man. When the radio crews had to work in or near the tern colonies and were unable to use their hands for protection, they balanced rocks large as a fist on their heads. For unmentioned reasons, the sight of the rocks stopped the terns' diving onslaughts, but at the same time seemed to "irritate them beyond measure."—Louise de K. Lawrence.

SYSTEMATICS

28. Weights of Massachusetts Quail and Comparisons with other Geographic Samples For Taxonomic Significance. Thomas H. Ripley. 1960. *Auk*, **77**(4), 445-447. Analysis of weights of Bobwhite Quail *(Colinus virginianus)* trapped in Barnstable County, Mass. in 1956 suggests the validity of a northeastern subspecies, *C. v. marilandicus*, proposed by Phillips in 1915 and supported by Aldrich in 1946. Ripley quotes Aldrich to the effect that where introduction and transplanting of game birds are employed, recognition of subspecies may be very important.

Ripley's paper does not mention the importance of the converse, that in determining a population's subspecific identity, it is vital to recognize the effect of introduction of stock from elsewhere. What are these Quail on Cape Cod (Barnstable County)? They are generally considered to be at least in part the descendants of southern stock. The great reduction of the species in eastern Massachusetts is ascribed to: "(1) overshooting; (2) mortality in heavy winter snows; (3) mortality from cold rains in the breeding season, as in 1903 and 1904; (4) above all, by the introduction of less hardy western or southern stock by sportsmen, which destroyed the original 'large, heavy and pale New England Quail.' Thus the remnant population on Cape Cod was exterminated by wet snow about 1857 and southern stock was introduced (Henry H. Fay, in *litt.* to W. Brewster). It was gone after 1860 at Nantucket (reintroduced after 1948). . . . It should be understood . . . that there has been continuous restocking by the Division of Fisheries and Game for many years. Modern skins do not match the original quail specimens found in the older collections, though Cape Cod specimens indicate survival of the original stock not later than 1872." (*The Birds of Massachusetts*, Griscom and Snyder, 1955, pp. 79-80—including a review of 134 Massachusetts specimens of this species.)

The problem is not limited to eastern Massachusetts. "The race *texanus* has been introduced widely, mainly with stock imported from Mexico, into many parts of the United States and British Columbia, within and beyond the ranges of *taylori* and *virginianus*, where, however, it has not become established. Though hybrids between *texanus* and the native races may have been common soon after introduction, neither the introduced nor the mixed stock seems to have persisted for more than a few years." (*Check-list of North American Birds*, A.O.U., 1957, p. 140.)

As Ripley is undoubtedly familiar with the history of this species in Massachusetts, his paper should be read as an argument that (1) his 282 trapped birds are descendants of the original native stock, with no significant mixture with the numerous introductions, in an area where the native birds were not just low in numbers but almost entirely extirpated; *or* (2) that under the influence of environment (Bergmann's Rule?), the *texanus* imports were modified in a relatively few generations to resemble the original stock in size, and differ significantly from their ancestral stock. Either of these propositions would be uncommonly interesting, if expanded and if supported by evidence. Unless one of these propositions is pressed to a successful conclusion, Ripley's data lack much relationship to Phillips' *marilandicus*.—E. Alexander Bergstrom.

BOOKS AND MONOGRAPHS

29. Atlas of European Birds. K. H. Voous. 1960. Thomas Nelson & Sons Limited, London. 284 pp., 419 maps, numerous photos. Size 10½ x 14". Price $15. No student of birds can afford to be without this excellent collection of maps showing at a glance the world-wide distribution of each of the 419 species of European birds. Nothing conveys the importance and significance of a species' range as does a map. The series given here present most clearly and dramatically the known distributional data for all the European species. These include, of course, a large number of North American species whose holarctic distribution is seldom appreciated by students who limit their perspective to North American birds.

While the book is worth the price for the maps alone, it goes a great deal farther. It is illustrated with some of the best black and white photographs available of, for a rough guess, at least 95 percent of the species covered, and each species is given from 300 to 500 words of text describing its faunal type, distribution, present status, habitat, food, and migratory movements. The text is written simply and clearly, and as the author himself translated it into English from the original Dutch edition, it is free of the usual errors and inconsistencies that so often mar translations of technical works.

More has been written on the birds of Europe than on those of any other part of the world, and the inquisitive reader can choose from a wealth of comprehensive texts in several languages still in print. Were I limited to a single volume on European birds for my reference shelf, I would unhesitatingly select this one as head and shoulders above any other I have seen for comprehensive inclusion of essential factual material, particularly from the distributional point of view. —O. L. Austin, Jr.

30. Birds of Anaktuvuk Pass, Kobuk, and Old Crow. A Study in Arctic Adaptation. Laurence Irving. 1960. *United States Museum Bulletin*, No. 217: 1-409. $2.00. Dr. Irving has had many years of experience in Alaska where he specialized in physiological researches on metabolic problems of arctic birds and mammals. In this book he describes the natural history and ecology of the birds at three localities in the interior of Alaska. He then discusses migration and origins, residence in the Arctic, biological aspects of migration and nesting, and, particularly important, arctic metabolic economy of warm-blooded animals. To mention only two findings: "Many arctic nesting populations of migratory birds arrive fat after rapid flights from distant wintering places." Not much difference was discovered in the thickness of feathers between arctic and tropical birds that were systematically related, but in the former species the contour feathers had "less rigid terminal barbs with barbules containing extended fine processes," thus enabling the retention of more insulating air by the arctic birds.

Dr. Irving speaks very highly of the keen interest in wild life taken by the mountain Eskimos and of the great help these people were to him. This volume makes a notable contribution both to the natural history and physiology of birds in the Arctic.—M. M. Nice.

31. Fauna of the Aleutian Islands and Alaska Peninsula. Olaus J. Murie. 1959. U. S. Fish and Wildlife Service, *North American Fauna*, No. 61: 1-406. $1.25. In 1913 the Aleutian Islands were set aside as a National Wildlife Refuge. Dr. Murie led expeditions in 1925, 1936, and 1937 to every island in the chain to investigate the fauna. Besides these observations the report incorporates all published records for the region. The first 26 pages discuss geography and geology, climate, environment and biotic distribution, and vegetation. Birds are treated in 234 pages and mammals in about 100. The final 40 pages are devoted to "Invertebrates and Fishes Collected in the Aleutians, 1936-38," by Victor B. Scheffer.

On the treeless Aleutians, "although the temperature is mild—neither very low in winter nor very high in summer—there is a minimum of sunshine and a maximum of fog, rain, and storm." Dr. Murie discusses the dark pigmentation of many animals supposedly in response to the high humidity of the region, and the frequent occurrence of giantism as shown in Song *(Melospiza melodia)* and Savannah Sparrows *(Passerculus sandwichensis)*, the Alaskan brown bear, and much sea life.

It is shocking to read of the destruction wrought by blue foxes. In a paragraph on "Birds vs. Blue-Fox Industry" the author writes: "On some of the smaller islands birds have been almost eliminated, and on many islands such birds as eider ducks have ceased to nest, except on a few offshore pinnacles where they can find protection. The cackling goose and lesser Canada goose have become so scarce that it is somewhat doubtful whether they can survive in the Aleutians. . . . Certain rare species, too, are threatened. The whiskered auklet is not abundant, and the Cassin's auklet has become very scarce."

There is something radically wrong when the Fish and Wildlife Service give permission to people to *stock a National Wildlife Refuge with predators* that destroy the birds the refuge was established to preserve!—M. M. Nice.

32. The Trumpeter Swan. Its History, Habits and Population in the United States. Winston E. Banko. 1960. *North American Fauna*, **63**: 1-214. U. S. Government Printing Office, Washington 27, D. C. Price $1.00. A handsome monograph with fine photographs and delightful sketches. Once an abundant and widespread species in North America, nesting from Missouri and Indiana to Alaska, *Olor buccinator* was brought through exploitation by the fur trade for over 100 years and shooting by settlers to a dangerously low point by 1900. Thanks to strict protection its numbers are estimated to reach at present about 1500, the majority of which are in British Columbia. The population is now as large as the present year-round accommodations available in our already stocked refuges can support, hence the problem is now one of transplanting breeding stock to other favorable localities. Life history and habits are excellently treated, thanks to Mr. Banko's wide personal experience with these birds and knowledge of the literature. A valuable report.—M. M. Nice.

33. The Birds of West-Central Ellesmere Island and Adjacent Areas. David F. Parmelee and S. D. MacDonald. 1960. *National Museum of Canada Bulletin* No. 169. 1-103. $1.50. From 16 April to 27 September, 1955 the authors investigated the bird life largely of the Fosheim Peninsula lying north of the 79th parallel. Twenty species were found "reproductively successful in one of the coldest and driest regions of the world," although in some summers they do not breed at all. Little evidence was found of a shorter breeding cycle than obtains in regions farther south. Details are given of the authors' experiences with each bird species. Among the most interesting are the descriptions of the close bond between the Turnstone *(Arenaria interpres)* and Knot *(Calidris canuta)*. "From the first of their actual nesting, the Turnstones seemed to be completely tolerant of one another and also of Knots which walked unmolested close to Turnstone eggs. Other species they chased vigorously. . . . Knot and Turnstone families band together in large numbers during the fledging period." This concentration serves as a real protection against Long-tailed Jaegers, *(Stercorarius longicaudus)*. A very interesting study, full of information on nesting in the Arctic.—M. M. Nice.

34. Birds of North Carolina. Pearson, T. G., Brimley, C.S., and Brimley, H. H., revised by Wray, D. L. and Davis, H. T. 1960. [dated 1959] N. C. State Museum, Raleigh, 434 pp., illustrated. Price $5.00. This volume was scheduled for publication several year ago and has been delayed by a printer's strike. The procedure of revision was to make a few minor deletions from the 1942 edition and to add, in a different type, some introductory matter and notes to many species. The illustrations are essentially the same as in the previous edition. A number are from the originals for the first edition of Peterson's "Field Guide"; two are added here from the third edition. The older illustrations, evidently printed from the plates used in 1942, are quite worn and will certainly not stand further use.

Most state bird books suffer from the attempt to do too many things at once. A popular account of the ecology and general distribution of bird life within a state is seldom compatible with a scientific statement of the differences between subspecies and the details of their distribution. The original authors may be held responsible for treating subspecies in the same way as species. North Carolina is unfortunate in being the meeting ground of a rather large number of subspecies. It is also unfortunate that no extensive collecting has been done in the northern Piedmont where the reviewer lives. Much remains to be learned in

this area; the subspecies of the loggerhead shrike, for instance, apparently vary with season. Further, as species often shift the boundaries of their breeding ranges, why should it be tacitly assumed that the boundaries between subspecies are permanent?

The revisers' attempt to bring the nomenclature into line with the current A.O.U. Check-List in general has succeeded. However, in the Rufous-sided Towhee *alleni* is retained in place of *rileyi*, and the stated distributions do not agree with Dickinson's monograph. *Sphyrapicus varius appalachiensis* Ganier is omitted. The omission of *Passerella iliaca zaboria* Oberholser 1946 is puzzling, for the U. S. National Museum has North Carolina specimens of it. In spite of all this, the book will be useful to the bird students of its state. Any future edition should be an entirely new book.—C. H. Blake.

35. Ducks, Geese, and Swans. Herbert H. Wong. 1960. Lane Book Company, Menlo Park, California. 65 pp. Price $2.95. This "Sunset Junior Book" is unusual. Drawings by William D. Berry of hundreds of waterfowl, including more than 100 in color, are authentic and tastefully done. The many line drawings include barley sprouts, immature aquatic insects, a U. S. Fish and Wildlife Service bird-band, and a map showing refuges and waterfowl management areas in western United States. The text is written especially for young people. A. Starker Leopold and Matthew E. Vessel served as consultants.

The book considers waterfowl in general including their special adaptations, food, and general ecology. Sections on migration, bird-banding, and refuges are balanced with discussions of dangers to waterfowl, including natural enemies and hunting pressures. Each of the species of swans, geese, and ducks found in the United States is discussed and figured. Also included are some exotics commonly found in parks. A short section on "water-bird companions" includes figures and a discussion of the Coot, and figures of grebes, a loon, and a cormorant.

The binding, paper, print, and the reproduction of the figures are excellent. Two minor errors: (1) transposed captions for the goldeneyes (p. 46) and (2) an impression that about one out of every six bands put on American birds (should be restricted to waterfowl) is returned (p. 55), are minor in the overall consideration. Of special interest is the message to elementary teachers and students on the disposition of bird-bands found. Although written for use in western United States, its coverage of waterfowl makes it nearly as useful for middle and eastern United States and for Canada.—L. Richard Mewaldt.

NEBBA FINANCIAL STATEMENTS, 1959-60

These figures cover the fiscal year from November 1, 1959 through October 31, 1960. The general account closed the year firmly in the black (after two deficit years), partly through some reduction in average length of issues, but also through increased dues, subscription, and back issue receipts. Actual cash on hand at the end of the fiscal year was lower than a year earlier, mostly because of expenditures on indexes (indexes on hand are not given any cash value in the statements).

The Nantucket Ornithological Research Station completed another long season; funds remaining will be used during 1961, for a shorter season.

Sales of mist nets were very heavy, including many foreign shipments. While no loans were outstanding at the beginning or end of the year, temporary loans reached a peak of nearly $1000 in June (1960), to finance more shipments from Japan. Our working capital in this account is still modest for the sales involved, particularly considering seasonal peaks in demand and the time it takes to obtain nets from the maker. Over 1500 nets were shipped during the year.

GENERAL ACCOUNT

Income Statement

Receipts

	Year ending Oct. 31 1959	Year ending Oct. 31 1960
Subscriptions and dues (current year)	$2798.07	$2957.63
Sale of back issues	84.48	290.60
Contributions		125.00
Bank interest	71.86	78.50
	$2954.41	$3451.73
Expenditures		
Printing of *Bird-Banding*	$2853.60	$2412.51
Mailing of *Bird-Banding*	339.08	397.39
Purchase of back issues		12.50
Other printing, stationery, postage etc.	243.57	246.66
Contributions	30.00	10.00
Bank charges	3.63	5.39
	$3469.88	$3084.45
Net Loss	$ 515.47	
Net Surplus		$ 367.28

Balance Sheet

Assets		
Cash	$3775.90	$3684.83
Back issues of *Bird-Banding*	1.00	1.00
Accounts receivable	17.25	3.75
	$3794.15	$3689.58
Liabilities and Net Worth		
Reserve for fourth quarter	$ 676.75	$ 740.26
Subscriptions paid in advance	193.25	212.61
Reserve for index fund	1310.40	772.91
Reserve for research fund	5.00	5.00
Life membership fund	500.00	500.00
Net worth	1108.75	1458.80
	$3794.15	$3689.58
Index Fund		
Reserve	$1300.40	$1310.40
Contribution	10.00	
Received from sale of 1941-50 index		34.00
Expenditures, 1941-50 index		546.49
Expenditures, 1951-60 index		25.00
	$1310.40	$ 772.91
Life Membership Fund		
Reserve	$ 500.00	$ 500.00

Mrs. James R. Downs, Treasurer

NANTUCKET ORNITHOLOGICAL RESEARCH STATION — 1960

Receipts

Balance forward January 1, 1960	$2,831.42
Donation	5,000.00
Savings Bank Interest	76.99
Federal Income Taxes withheld	472.00
Social Security Taxes withheld	141.00
TOTAL	$8,521.41

Disbursements

Salaries	$4,700.00
Travel expense	279.96
Income Taxes withheld	472.00
Social Security Taxes	282.00
Insurance	170.23
Supplies and Equipment	118.10
Bank charges	1.42
Balance forward December 31, 1960	2,497.70
TOTAL	$8,521.41

John H. Conkey
Assistant Treasurer

MIST NET ACCOUNT

Profit and Loss Sheet

	1959	1960
Receipts (sale of nets)	$2,871.93	$5,027.99
Expenses		
Cost of nets, customs, postage	2,323.38	5,089.25
Miscellaneous	82.50	111.86
Paid on loans	300.00	—
Total	$2,705.88	$5,201.11
Net operating income	$498.55	$279.58

Balance Sheet

Assets		
Cash	$370.81	$442.39
Accounts receivable	335.92	90.85
Nets on hand (at cost to date)	215.10	363.54
Nets on order "	805.00	1,109.63
Other	10.00	10.00
Total	$1,736.83	$2,016.41
Liabilities		
Nets paid in advance	$3.82	—
Reserve for customs duties	300.00	500.00
Reserve for contingencies	300.00	500.00
Surplus	$1,133.01	$1,016.41

E. A. Bergstrom,
Assistant Treasurer

CONSOLIDATED BALANCE SHEET

Assets

	1959	1960
General	$3,794.15	$3,689.58
NORS	2,831.42	2,497.70
Net account	1,736.83	2,016.41
Total	$8,362.40	$8,203.69

Liabilities

Paid in advance, accounts payable, loans		
General	$870.00	$952.87
NORS	—	—
Net account	3.82	—
Subtotal	$873.82	$952.87
Other		
General	$2,924.15	$2,736.71
NORS	2,831.42	2,497.70
Net account	1,733.01	2,016.41
Subtotal	$7,488.58	$7,250.82
Total	$8,362.40	$8,203.69

BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

Published quarterly for:

THE NORTHEASTERN BIRD-BANDING ASSOCIATION
THE EASTERN BIRD-BANDING ASSOCIATION
THE INLAND BIRD-BANDING ASSOCIATION

Applications for membership in these associations should be sent to their respective secretaries. The annual membership dues of $5 per year ($7 family membership, for adults) in the Northeastern Association include a subscription to *Bird-Banding*. Membership in the Eastern and Inland Associations is $2 each per year; members of those associations who wish to receive *Bird-Banding* may send $4 direct to the secretary-treasurer. Subscription price to non-members of the associations is $5 per year; single copy $1.25.

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